BS EN 12929-1:2015



BSI Standards Publication

Safety requirements for cableway installations designed to carry persons — General requirements

Part 1: Requirements for all installations

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National foreword

This British Standard is the UK implementation of EN 12929-1:2015. It supersedes BS EN 12929-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/20, Aerial ropeways.

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

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Foreword

This document (EN 12929-1:2015) has been prepared by Technical Committee CEN/TC 242 “Safety requirements for cableway systems for passenger transportation”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2015, and conflicting national standards shall be withdrawn at the latest by July 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

This document replaces EN 12929-1:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2000/9/EC.

For the relationship with EU Directive 2000/9/EC, see informative Annex ZA, which is an integral part of this document.

The following main changes have been made to EN 12929-1:2004:

— In Clause 1 (formerly Subclause 1.1) supplementations have been made with regard to the protection of workers and the passenger circle.

— In 4.2.1 (formerly Subclause 1.3.1) EN 12929-1 has also been included with regard to the exception to the requirements.

— In Clause 3 the terms and definitions have been removed, as the reference to EN 1907 is sufficient.

— The former Subclause 4.2.2 “Safety analysis” has been removed, as the requirements listed there are established in Directive 2000/9/EC.

— In 5.2.2 the limit for the permissible transverse acceleration for funicular railways has been raised.

— In 5.2.4 detailed regulations for establishing the passing loop of funicular railways have been included.

— 6.1 has been added and establishes the basic requirements for the limit profile. The following subclauses in Clause 6 have been promoted.

— In 6.3.1 the general requirements for the limit profile have been supplemented to include aerial ropeways.

— In 6.3.2 by changing the reduction coefficient, alignment with EN 12930:2014 has been achieved and the ice curtain for the lateral deviation of the ropes has been redefined.

— In 6.3.4 the regulations with regard to the minimum values for the angle of the transverse sway of the carriers have been supplemented.

— In 6.3.5 the permissible impact speed for reversible aerial ropeways has been increased.

— In 6.3.7 the regulations with regard to the guides have been adopted from the former 7.3.2, as the guides influence the limit profile. The regulations have been supplemented and clarified.

— In 6.4.1 the regulations for the limit profile of ski-tows with regard to the combination of transverse and longitudinal sway have been established congruent to the aerial ropeways.

— In 6.4.5 the regulations with regard to the rotation of tow-hangers have been clarified.

— In 6.5 and 6.6 regulations with regard to the limit profile for signal cables, restraint ropes, marker ropes and ropes on evacuation railways have been adopted from EN 12930, whereby they are aligned with ropes on aerial ropeways.

— 7.1 has been revised in terms of content and structure.

— 7.3 has been revised in terms of content and structure and includes regulations regarding the safety distances which were previously covered in 7.5. The former 7.3.2 regarding guides has been moved to 6.3.7, as the limit profile is influenced by guides.

— In 7.4 the assumptions for the verification of tracks for reversible aerial ropeways, for pulsed movement aerial ropeways and bi-cable aerial ropeways have been clarified.

— In 7.5 regulations for ski-tows have been revised in terms of content and structure.

— In 8.1.1 the maximum height above ground has been restricted to the height for a rope that is carrying passengers.

— In 8.2 and 8.3 the height above ground for aerial ropeways has been revised in terms of content and structure.

— In 9.2 the maximum operating speeds of cableway installations have been revised in terms of content and structure.

— In 10.1.1 the regulations for the omission of a recovery drive have been concretised.

— In 10.1.6 the regulations for the independence of the recovery drive from the main drive have been concretised.

— In 10.2.4 the residual risk of a standstill caused by the on-board brakes has been taken into consideration.

— In 10.3.2, the requirement for the arrangement of the emergency stop buttons which are accessible to all persons when entering and exiting ski-tows has been restricted.

— In 10.3.4 the permissible stopping distances for ski-tows have been modified.

— The previous point 10.3.5, which established the design of the brakes for ski-tows, has been deleted.

— In 11.1.5 the requirements for work positions and passageways for operating personnel has been modified.

— In 11.1.7 the distances between the carriers and the loading platform edge have been modified.

— In 11.1.9 additional requirements have been included for the unloading areas of chairlifts.

— In 11.1.10 the height of the seat surface of chairlifts in the loading and unloading areas has been modified.

— In 11.2.3 the execution of the stabilisation area, the safety area and the ramp after the loading area has been modified.

— In 11.2.11 the occupation instructions in the area of the valley station of chairlifts and the reference to the relevant Standard have been modified.

— In 11.3.2 the requirements for unloading areas of chairlifts have been modified and supplemented.

— In 11.3.4 for the limits of the height above ground in the approach area the option of locking system have been taken into consideration.

— In 11.3.5 the regulations for the ramps after the unloading area of chairlifts have been clarified.

— In 11.3.6 the existing requirement for chairlifts with carriers with fixed grips was further extended to chairlifts with detachable grips.

— In 11.3.7 the regulations with regard to the emergency unloading area have been clarified.

— In 11.3.8 the passenger instructions in the area of the mountain station of chairlifts and the reference to the relevant Standard have been modified.

— In 11.6.1 the regulations for the loading area of ski-tows have been supplemented.

— In 11.6.4 the passenger instructions in the area of the valley station of ski-tows and the reference to the relevant Standard have been modified.

— 11.7.2 was reformulated as the height above ground of a ski-tow has not been defined.

— In 11.7.9 the location of the safety devices at the unloading area of ski-tows has been clarified.

— In 12.4.1 the exception option of omitting a monitoring of the movement between the track rope and the haul rope in the case of bi-cable uni-directional aerial ropeways has been removed, as this no longer complied with the “state of the art” and a time span specified in which no switch-off shall take place.

— 12.6.2 has been reformulated as the height above ground of a ski-tow was not defined.

— In 12.6.3 the regulations for low level ski-tows with regard to twist have been supplemented.

— In 13.1 the regulations for the evacuation plan were removed and exclusive reference is made to EN 1909.

— In 13.2 a supplementary regulation has been included for the evacuation pathway for funicular railways.

— In 14.1 the hazards from fire events in the vicinity of the cableway installation have been supplemented.

— In 14.2 the requirement for inspecting the rope has been supplemented with established or assumed lightning, as EN 12929-2 no longer specifies this regulation.

— In 14.4 the requirement of a wind measurement device on funicular railways has been taken into consideration.

— In 15.4 the access to the line of funicular railways with automatic operation has been clarified.

— In 15.6 the access to the carriers of funicular railways with automatic operation has been clarified.

— In 15.7 the regulations regarding special safety devices on the carriers of funicular railways with automatic operation have been removed and exclusive reference is made to EN 13796-1.

— In Annex A the sketch and the key for explaining 11.2 has been adapted to the Standard specifications.

— In Annex B the sketch and the key for explaining 11.3 has been adapted to the Standard specifications.

— In Annex C the technical documents have been supplemented and clarified.

— In Annex D the A-deviation for Germany has been removed.

— Annex ZA has been updated.

EN 12929 with the generic title “Safety requirements for cable way installations designed to carry persons - General requirements”, consists of the following parts:

— *Part 1: Requirements for all installations.*

— *Part 2: Additional requirements for reversible bi-cable aerial ropeways without carrier truck brakes.*

Part 1 of this document deals with general requirements applicable to all cableway installations designed to carry persons; Part 2 deals with the supplementary requirements applicable to reversible bi-cable aerial ropeways without carrier truck brakes.

This European Standard forms part of a series of European Standards concerning safety requirements for cableway installations designed to carry persons. This series of Standards comprises the following parts:

— EN 1907 – *Terminology*

— EN 12929 – *General requirements*

— EN 12930 – *Calculations*

— EN 12927 (all parts) – *Ropes*

— EN 1908 – *Tensioning devices*

— EN 13223 – *Drive systems and other mechanical equipment*

— EN 13796 (all parts) – *Carriers*

— EN 13243 – *Electrical equipment other than for drive systems*

— EN 13107 – *Civil engineering works*

— EN 1709 – *Precommissioning inspection, maintenance and operational inspection and checks*

— EN 1909 – *Recovery and evacuation*

— EN 12397 – *Operation*

— EN 12408 – *Quality assurance*

This series of Standards forms a complete set with regard to the design, manufacture, erection, maintenance and operation of all cableway installations designed to carry persons.

In respect of ski-tows, the drafting of this document has been guided by the works of the International Organisation for Transportation by Rope (OITAF).

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Belgium, Bulgaria, Denmark, Germany, the former Yugoslav Republic of Macedonia, Estonia, Finland, France, Greece, Ireland, Iceland, Italy, Croatia, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Norway, Austria, Poland, Portugal, Romania, Sweden, Switzerland, Slovakia, Slovenia, Spain, Czech Republic, Turkey, Hungary, United Kingdom and Cyprus.

1 Scope

This European Standard specifies the general regulations for safety requirements for cableway installations designed to carry persons. Supplementary safety requirements for reversible bi-cable aerial ropeways without carrier truck brakes are established in EN 12929-2.

This Part of the EN 12929 defines general technical characteristics and prescribes design principles and general safety requirements.

This Part of the EN 12929 does not deal with details of operation and maintenance, calculations and detailed requirements for the manufacture of components.

This Part of the EN 12929 includes requirements relating to the prevention of accidents and the protection of workers irrespective of the application of national regulations.

National regulations of a building or federal/state nature or which serve to protect particular groups of people remain unaffected.

It may not always be possible for all types of cableway installation to transport all particular groups of people (e.g. persons with restricted mobility). The objective should be, however, for a cableway installation to enable the transportation of the largest possible passenger population.

This standard does not apply to cableway installations for the transportation of goods or to lifts.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1709, *Safety requirements for cableway installations designed to carry persons — Precommissioning inspection, maintenance, operational inspection and checks*

EN 1907, *Safety requirements for cableway installations designed to carry persons — Terminology*

EN 1908, *Safety requirements for cableway installations designed to carry persons — Tensioning devices*

EN 1909, *Safety requirements for cableway installations designed to carry persons — Recovery and evacuation*

EN 12385-8, *Steel wire ropes – Safety – Part 8: Stranded hauling and carrying-hauling ropes for cableway installations designed to carry persons*

EN 12385-9, *Steel wire ropes – Safety – Part 9: Locked coil carrying ropes for cableway installations designed to carry persons*

EN 12397, *Safety requirements for cableway installations designed to carry persons — Operation*

EN 12927 (all parts), *Safety requirements for cableway installations designed to carry persons — Ropes*

EN 12929-2, *Safety requirements for cableway installations designed to carry persons — General requirements — Part 2: Additional requirements for reversible bi-cable aerial ropeways without carrier truck brakes*

EN 12930, *Safety requirements for cableway installations designed to carry persons — Calculations*

EN 13107, *Safety requirements for cableway installations designed to carry persons — Civil engineering works*

EN 13223, *Safety requirements for cableway installations designed to carry persons — Drive systems and other mechanical equipment*

EN 13243, *Safety requirements for cableway installations designed to carry persons — Electrical equipment other than for drive systems*

EN 13796 (all parts), *Safety requirements for cableway installations designed to carry persons — Carriers*

EN ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100)*

EN ISO 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857)*

3 Terms and definitions

For the purposes of this document, the terms and definitions in accordance with EN 1907 apply.

4 Safety requirements applicable to cableway installations

4.1 General principles

4.1.1 Stringent safety requirements are of the utmost importance for the design, manufacture, erection, maintenance and operation of cableway installations.

The design, manufacture, erection, maintenance and operation of cableways shall only be entrusted to contractors and experts who have the necessary knowledge and experience and who can ensure careful execution of the installation and proper management of the operation.

All the components shall be calculated exactly, be of a good mechanical and electrical design and be manufactured from adequate, defect-free materials possessing the required characteristics.

4.1.2 All components shall be kept in working order and in good condition. Reference is made to EN 1709 and EN 12397.

4.1.3 In addition to the European Standards specific to cableway installations, the relevant European specifications shall be used for the design, manufacture, erection, maintenance and operation of cableways.

4.1.4 This document takes into account, in certain cases, the careless behaviour of passengers. In all cases, use of the cableway in accordance with its intended use is assumed and not misuse of the installation.

4.2 Exceptions

4.2.1 Exceptions to the requirements of Standards EN 1709, EN 1908, EN 1909, EN 12385-8, EN 12385-9, EN 12397, EN 12927 (all parts), EN 12929-1, EN 12929-2, EN 12930, EN 13107, EN 13223, EN 13243, EN 13796 (all parts) are permissible, particularly in the case of innovation. These exceptions shall be justified by a safety analysis and offer at least an equivalent level of safety.

4.2.2 Exceptions to this Standard are also permissible in the case of replacement of components in existing installations.

4.3 General safety requirements applicable to the installations and to their components

4.3.1 General safety principles

All cableway installations designed to carry persons shall be designed, manufactured and operated by applying the following principles in the order indicated:

a) avoid or at least limit the risks by appropriate design or construction measures;

b) take the necessary protective measures with respect to remaining risks which cannot be avoided by design and construction measures;

c) define and make known the precautions to be taken to reduce those risks which it has not been possible to avoid completely by the previous preventative and protective measures.

In the case of installations and components complying with EN 1709, EN 1908, EN 1909, EN 12397, EN 12927 (all parts), EN 12929 (all parts), EN 12930, EN 13107, EN 13223, EN 13243 and EN 13796 (all parts), it can be assumed that these safety principles are observed.

4.3.2 Possible injuries to persons

Those hazards which can in particular result in the following injuries to persons shall be taken into account:

a) injuries caused by falls (including those caused by carriers falling);

b) bruising, crushing or injury by trapping of persons (other than falls);

c) impairments to health resulting from extended exposure of persons to adverse weather conditions;

d) other dangers to health, for example electrocution, burns, noise, air pollution, inhalation of poisonous gases, etc.

4.3.3 Hazard scenarios

The following events can give rise to hazardous situations which are avoided or reduced by the safety requirements of this document:

a) failure (rupture, malfunction or non-functioning) of a component of an installation;

b) breakdown of correct interaction between the components in an installation or between the components and their environment;

c) unforeseeable incorrect behaviour of persons (passengers, operating personnel or third parties) as well as the foreseeable misuse by these persons;

d) foreseeable external events (for example, caused by avalanches, landslides, rock falls, lightning, piste grooming machines, aircraft).

The following events in particular shall be considered:

— failure of or defects in the supporting structures of the civil engineering structures;

— defective condition of loading and unloading areas;

— failure of tensioning systems and rope end fixings;

— failure of rope support and guide elements;

— failure of carrier components;

— failure of or defects in drive systems and brakes;

— failure of or defects in control and monitoring systems, safety and signalling installations;

— incorrect behaviour of persons, operating personnel or third parties who are being transported.

Chain reactions which can happen as a result of an event shall be taken into account. On the other hand, the simultaneous occurrence of two independent hazardous situations may be ignored.

4.4 Safety requirements applicable to installations

4.4.1 General

This document sets out general measures to reduce the hazards listed in 4.3 and to prevent the hazardous situations.

4.4.2 Protective measures

In particular, safety devices are required as protective measures to detect and correct the hazardous situations listed below. Table 1 below indicates the Standards which deal with each of these hazardous situations.

Table 1 – List of hazardous situations

Type of installation	Hazardous situation	Standards
all installations except ski-tows	inadmissible variation in the nominal tension of the moving ropes (except for tensioning by counterweights)	EN 1908 EN 13243
	arrival at the end positions of the tensioning devices	EN 1908 EN 13223
	inadmissible exceeding of speed	EN 13223
	inadvertent runback	EN 13223
	abrupt change in the drive torque beyond the limit values for the installation	EN 13223 EN 13243
	failure of doors of closed carriers to lock before leaving the station	EN 13223 EN 13243
	inadvertent start-up	EN 13243
funicular railways and bi-cable aerial ropeways	incorrect position of the haul rope relative to its supports or to the track rope (e.g. crossing of the haul rope and track rope, derailment)	EN 12929-1 EN 13223 EN 13243
	inadmissible reduction in the haul rope tension (except for bi-cable uni-directional aerial ropeways)	EN 12929-1 EN 13223 EN 13243
funicular railways	inadmissible speeding and/or inadvertent runback of carriers	EN 13223
Mono-cable aerial ropeways	derailment of the towing rope on line support structures and at rollers in the station having a similar function to line rollers	EN 12929-1 EN 13223 EN 13243
funicular railways, reversible aerial ropeways and pulsed movement aerial ropeways	failure to slow down on approach to stations or at other points of the line	EN 13223
	overrunning of end points at the end of the line	EN 13223 EN 13243
cableway installations with detachable carriers	failure of grips to attach to or detach from the rope	EN 13796-1 EN 13223
	inadmissible deviation in the carrier pitch	EN 13796-1 EN 13223
	incorrect progression of carriers in the station	EN 13796-1 EN 13223
chairlifts	overrunning of unloading area by occupied carriers (with the exception of intermediate stations)	EN 12929-1 EN 13223
ski-tows	inadmissible variation in the nominal tension in the towing rope (except for tensioning by counterweights)	EN 1908 EN 13223
	inadvertent start-up	EN 13243
	overrunning of reception area by a skier	EN 13223
	abrupt temporary change in the drive torque beyond any limit value characteristic of normal operating conditions	EN 13223 EN 13243
	incomplete retraction of a tow-hanger	EN 13223
	derailment of the towing rope on line support structures and at rollers in the station having a similar function to line rollers	EN 12929-1 EN 13223 EN 13243

4.5 General requirements for the protection of workers

4.5.1 Cableway installations shall be designed and constructed so that operation and maintenance work are possible without exposing operating personnel to the associated risks.

Cableway installations shall be designed and constructed so as to reduce essential maintenance work as much as possible. Components requiring regular maintenance shall be positioned so that they are easily accessible.

NOTE With regard to greasing, for example, the requirement for reduction of maintenance is met if the technical design and construction avoids manual greasing as far as possible (e.g. by using permanently lubricated roller or ball bearings or a centralised power-operated greasing system).

4.5.2 In working areas and traffic areas, as well as in the vicinity of elevated maintenance positions, danger areas of mechanical equipment and carriers are to be avoided by taking suitable precautions in design and construction.

If danger areas cannot be avoided by these measures, these shall be safeguarded in compliance with EN ISO 12100. For requirements for the design and arrangement of safeguarding structures, EN ISO 13857 shall be observed.

NOTE Danger areas are, for example, those areas where there is a danger of crushing, shearing, entanglement or entrapment; they are avoided when, for example, the minimum distances recommended in EN 349 to avoid the crushing of parts of the body are observed.

For elevated maintenance positions, guards at places where there may be entrapment by the rope may be dispensed with.

For the purposes of this document:

— working and traffic areas include work positions at floor level and passageways for the operating personnel. Work positions at floor level include, for example, passenger loading and unloading areas and control stations;

— elevated maintenance positions are positions which are not directly accessible from the ground and from which maintenance operations on electrical or mechanical components of the installation and on the carriers are carried out.

Direct access to components means, for example, being able to reach them without needing to use ladders.

4.5.3 Maintenance switches shall be made available to the operating personnel in accordance with EN 13243.

4.5.4 Emergency stop buttons shall be made available to the operating personnel and, if necessary, the passengers in accordance with EN 13243.

5 Line and line profile

5.1 Choice of line

The line of funicular railways, aerial ropeways and ski-tows shall be selected to ensure that there is no risk to the safety of passengers, operating personnel and third parties, whether or not the installation is in operation.

When selecting the cableway system, the following shall be taken into account:

— the characteristics of the terrain over which the installation travels, particularly with regard to evacuation;

— the geological and hydrological conditions of the subsoil;

— environmental hazards (e.g. landslides, rock falls, meteorological conditions, intersections with roads).

If necessary, protective measures shall be taken.

5.2 Line of funicular railways

5.2.1 When establishing the course of the line of funicular railways, the following shall be taken into account:

— the transverse acceleration acting on the passengers;

— the safe support of the rope on the rollers;

— the safe guidance of the carriages on the track, also taking into account any possible load reduction on the wheels;

— the necessary braking force and the safe functioning of the track brake;

— the characteristics of the carriers.

5.2.2 The transverse acceleration shall not normally exceed 0,65 m/s^2. It may increase to 1,0 m/s^2 if a transition curve restricts the jerk to maximum 0,8 m/s^3.

Superelevation of the track to limit the transverse acceleration is permissible.

Neither superelevation nor the radii selected for curves shall adversely affect the safe guidance of the carriages and the effectiveness of the track brakes.

5.2.3 For reasons of safety and comfort during the journey, the gradient of the track shall be selected so that the actual longitudinal inclination of the carrier floor varies at most by ± 0,20 rad to the horizontal.

5.2.4 The length of the passing loop shall be established so that when the track brakes are induced as a result of a ruptured haul rope or if the rope end fixings fail, there is no collision between the carriers.

When the track brakes are triggered on descending carriers, the following shall be taken into account:

— most unfavourable carrier positions;

— reaction time of the on-board brake on descending carriers with subsequent stopping distances;

— drive stopping distances, coasting of ascending carriers;

— downhill force of the counter rope.

When the track brakes are triggered on ascending carriers, the following shall be taken into account:

— most unfavourable carrier positions;

— position of the ascending carrier after own deceleration and application of the on-board brake after reverse travel direction;

— position of the descending carrier after application of the on-board brake as a result of overspeed with subsequent stopping distances;

— downhill force of the counter rope.

5.3 Line of aerial ropeways

5.3.1 Generally, the line of an aerial ropeway is a straight line between the stations and the track gauge is constant.

5.3.2 In the case of deviations of the rope in the horizontal plane, to obtain a deviation of the line or a change in track gauge, the following conditions shall be observed:

a) for all aerial ropeways: the horizontal force resulting from the deviation and the rope tension under any load shall not exceed 10 % of the resultant bearing force acting on the rope;

b) for bi-cable uni-directional aerial ropeways: the fleet angle formed by the track rope on a rope shoe shall not exceed 0,005 rad;

c) for mono-cable aerial ropeways: the fleet angle formed by the carrying-hauling ropes on roller batteries shall not exceed 0,005 rad.

Wind and dynamic influences shall not be taken into consideration.

5.3.3 For greater deviations that do not meet the requirements of 5.3.2, suitable devices or suitable line structures shall be provided.

5.4 Length of spans in aerial ropeways

5.4.1 In aerial ropeways, the lengths of the spans and their relationships to each other shall be selected so that they do not have an adverse effect on the dynamic behaviour of the moving ropes.

5.4.2 In the case of a uni-directional aerial ropeway with detachable grips, where no specific devices are provided to prevent a carrier which is not properly attached from leaving the station, the length and gradient of the spans adjacent to the station shall be chosen so as to prevent such a carrier from running away along the line.

The distance between the last device monitoring the attachment of grips in the station and the beginning of the downward slope (for example start of the roller battery on the next line support structure) shall be chosen as a function of the stopping distance after triggering of this device. With regard to this, two cases are to be distinguished:

a) triggering of the safety device and response of the first braking system, where an increase of 20 % in the calculated value of the stopping distance shall be considered;

b) triggering of the safety device, failure of the first braking system and triggering of the braking deceleration monitoring system, where no increase in the calculated value of the stopping distance corresponding to the second triggered braking system shall be considered.

In the case of mono-cable aerial ropeways, the chord of such spans shall be approximately horizontal (maximum gradient 0.01 rad). In the case of bi-cable aerial ropeways, the chord of these spans shall rise along the line so as to enable the carriers to stop safely due to their own deceleration.

5.4.3 In the case of mono-cable aerial ropeways where there is no specific device to prevent a carrier which is not properly attached from leaving the station, physical measures shall be taken to prevent such a carrier from falling after it has left the station.

This requirement need not be considered if the only carriers which leave the station are unoccupied and if third parties (e.g. on a path passing underneath) are not endangered by a possible fall.

5.4.4 If physical measures are taken to prevent a carrier which is not properly attached from leaving a station, account shall be taken of their effect on the whole installation, particularly when determining maximum longitudinal sway in accordance with 6.3.5.

5.4.5 The requirements of Sub-clauses 5.4.2 to 5.4.4 do not apply if slipping and fall of a carrier which is not properly attached are rendered impossible, for example by a redundant arrangement of grips and attachment devices (e.g. in double mono-cable aerial ropeways).

5.5 Line of ski-tows

5.5.1 If the installation is stationary for a prolonged period of time or a passenger falls onto the tow-track, it shall be possible for all users to leave the tow-track without danger or delay and reach a safe area.

5.5.2 In the case of low-level ski-tows, the tow-track shall be visible from the monitoring points.

5.5.3 The longitudinal gradient at any point of the tow-track shall not exceed the following values:

a) in the case of low-level ski-tows:

   1) where the passengers hold directly onto the towing rope: 25 %;

   2) with tow-hangers: 40 %;

b) in the case of ski-tows with a rope at high level:

   1) with tow-hangers for 2 persons: 50 %;

   2) with tow-hangers for 1 person: 60 %.

   In the case of high-level ski-tows equipped with tow-hangers for 2 persons, the gradient can be increased to 60 % for a maximum length corresponding to twice the pitch between tow-hangers. Such tow-track sections shall be immediately preceded by a less steep section of at least the same length with a gradient of not more than 40 %.

5.5.4 Downhill slopes on the tow-track are permissible with an average gradient measured over a length corresponding to the minimum pitch between tow-hangers, as follows:

a) with tow-hangers for 2 persons: to a maximum of 3 %;

b) with tow-hangers for 1 person: to a maximum of 5 %.

5.5.5 The transverse gradient of the tow-track shall be approximately 0 % with the following tolerances:

a) with tow-hangers for 2 persons: up to ± 5 %, exceptionally, ± 10 % over short sections (e.g. in curves or in sections with an increased longitudinal slope in accordance with 5.5.3);

b) with tow-hangers for 1 person: up to ± 10 %.

There shall be no transverse gradient towards a line support structure.

6 Limit profile

6.1 General

The limit profile for cableway installations is the space requirement of the ropes, carriers or tow-hangers and, if necessary, the hand, foot and ski areas as well as the transported goods.

The limit profile shall be examined for “in operation” and “out of operation” cases.

6.2 Limit profile of funicular railways

The following shall be taken into account for the limit profile:

— movement of the carrier in the horizontal and vertical planes when travelling round curves in the track;

— the lateral play of the carrier;

— the possible movement of the carrier on its suspension in all directions;

— the lateral movement of the wheels relative to the rails;

— the possible dimensional tolerances (e.g. on the carrier, on the position of the rails);

— a minimum kinematic space requirement of 0,05 m on both sides, unless the installation conditions require a more exact investigation of the kinematic space requirements;

— the hand area.

The hand area is: 1,00 m for all window openings and for open carriages.

Where a hopper window does not open more than 0,20 m, the hand area is:

— 0,20 m, where the lower edge of the open window is at least 1,80 m above the floor of the carrier;

— 0,50 m, where the lower edge of the open window is 1,50 m to 1,80 m above the floor of the carrier.

6.3 Limit profile of aerial ropeways

6.3.1 General

The following shall be taken into account for the limit profile:

— the lateral deviations of the ropes (6.3.2);

— the vertical deviations of the ropes (6.3.3);

— the transverse sway of the carriers (6.3.4);

— the longitudinal sway of the carriers (6.3.5);

— the hand, foot and ski areas (6.3.6).

The combination of transverse and longitudinal sway – apart from with guides according to 6.3.7 - may be ignored.

When out of operation, the carriers shall be taken into account if they remain on the line. They shall then be considered as unoccupied.

At crossing points or approach areas of two clearance profiles, the limit profile of the cableway installation and also a derailment of a rope in the rope catcher or in the catcher arm on a line support structure shall be taken into consideration.

6.3.2 Lateral deviation of the ropes

The lateral deviation of the ropes as a result of the wind is to be calculated with a reduced dynamic pressure q':

$$q' = q \times (l^{*'} / l^{*})^2 \quad (1)$$

Where

q Minimum dynamic pressure

— in operation: $q = 0{,}20$ kN/m^2;

— out of operation: $q = 1{,}20$ kN/m^2;

l^* slope length of span;

$l^{*'}$ national field length.

The dynamic pressure q' acts as a uniformly distributed load over the total slope length of span l^*.

The notional field length $l^{*'}$ is calculated from the slope field length l^* by means of the following equation:

$$l^{*'} = l^* \times \delta \quad (2)$$

Where δ is the reduction coefficient and amounts to:

— 1,00 at $l^* \leq 200$ m;

— 0,65 at $l^* = 900$ m;

— 0,50 at $l^* \geq 2\,000$ m.

With a slope field length l^* between 200 m and 900 m or between 900 m and 2 000 m, δ shall be established by linear interpolation.

When establishing the lateral deviation, the increase in the lateral windage areas of the ropes as a result of an ice curtain shall be taken into consideration. Where an expert opinion establishes no other values, an ice sheet with an ice thickness of

— 20 mm for ropes with a nominal rope diameter ≤ 10 mm;

— 25 mm for ropes with a nominal rope diameter ≥ 100 mm;

shall be assumed.

With a nominal rope diameter between 10 mm and 100 mm, the ice thickness shall be established by linear interpolation.

NOTE If required by local climatic conditions, a greater ice thickness shall be assumed. In the case of favourable climatic conditions, lower values may also be applied.

To establish the lateral deviation of the ropes, the following cases shall be assumed:

a) in operation

1) 100 % dynamic pressure without ice sheet;

2) 100 % dynamic pressure at 40 % of the ice thickness;

3) 80 % of the dynamic pressure at 100 % of the ice sheet;

b) out of operation

1) 100 % dynamic pressure without ice sheet;

2) 65 % dynamic pressure at 40 % of the ice thickness;

3) 40 % of the dynamic pressure at 100 % of the ice sheet.

In the case of ropes which are moved or driven during operation, a simultaneous action of wind and ice during operation shall not be taken into consideration.

When establishing the lateral movement of the rope, no dynamic actions shall be taken into consideration. The working area of regulated tensioning devices shall be taken into consideration.

6.3.3 Vertical deviation of the ropes

When calculating the extreme vertical deviation of the ropes, account shall be taken of:

a) in operation

— 1) the imposed load of the carriers;

— 2) the dynamic effects of starting and when braking;

— 3) the working area of regulated tensioning devices.

The dynamic effect may be taken into account in a simplified manner by assuming variations to the calculated extreme sag of the rope under the uniform movement as a result of the following:

— 4) for track ropes at least ± 10 %;

— 5) for haul ropes at least ± 20 %;

— 6) for carrying-hauling ropes at least ± 25 %.

b) out of operation

1) the effect of the ice load assumed in accordance with EN 12930;

2) the working area of regulated tensioning devices.

6.3.4 Transverse sway of the carriers

The following minimum values shall be taken into account for the transverse sway angles of the carriers in the stations and on the line, measured from their empty positions at rest:

a) for closed carriers

— 1) without taking into consideration a hand area: 0,34 rad;

— 2) with a hand area to be taken into consideration (if applicable): 0,30 rad;

Relative to line structures, by applying guides the value of the transverse sway can be restricted to the following values (if necessary, whilst taking into consideration the hand area), if the carrier

3) is unaccompanied:

— i) at speeds in excess of 5,0 m/s: 0,25 rad;

— ii) at speeds up to max. 5,0 m/s: 0,20 rad;

4) is attended and a standstill of the installation or a reduction in the speed of the carrier is possible at any time:

— i) at speeds in excess of 7,0 m/s: 0,15 rad;

— ii) at speeds up to max. 7,0 m/s: 0,12 rad;

b) for occupied open carriers, taking into account the hand, foot and ski areas as defined in 6.3.6: 0,20 rad;

c) for empty open carriers: 0,34 rad.

For maintenance carriers, deviating regulations in accordance with EN 13796-1 may be applied.

In the case of bi-cable uni-directional aerial ropeways with unattended closed carriers, due to calculated verification, values of transverse sway towards guides smaller than those mentioned in paragraph a) are permissible. the verifications shall take into consideration the most unfavourable operating scenario and the most unfavourable load of the carriers (e.g. carriers empty or partially loaded on one side).

For bi-cable aerial ropeways with two track ropes or for double mono-cable aerial ropeways, lower values may be permissible even without guides, if

— the factors influencing the limit profile (e.g. the play of the carriers, their movement on their suspensions when approaching line support structures and the dimensional tolerances) are taken into consideration, and the established limit profile of the cabins for components of the stations or line structures is increased by 0,30 m;

— it can be demonstrated that the carrier trucks can never be lifted off their track ropes and that carrying-hauling ropes can never lift up from their supports. For grips of mono-cable aerial ropeway carriers, the minimum transverse sway to be considered shall be 0,20 rad in relation to the flanges of the rollers of the carrying-hauling ropes, whereby evidence shall be provided to show that a carrier unfavourably loaded on one side does not deviate more than 0,15 rad from the position of the empty carrier. For the design of roller flanges, EN 13223 applies. EN 13796-1 applies for the design of grips.

In the stations, the transverse sway to be taken into account may be reduced by physical means to values lower than those mentioned above.

6.3.5 Longitudinal sway of carriers

The longitudinal sway to be taken into account for the carriers - in the stations and on the line - shall be at least 0,34 rad.

The value of 0,34 rad may be reduced to the value β for uni-directional aerial ropeways with correctly functioning drive brakes with the following approximation formula, where a deceleration *a* of at least 1,75 m/s^2 shall be assumed:

$$\tan\beta = \frac{2a \cdot \cos\alpha}{g}$$

- α Gradient between the tangents of the trajectory and the horizontals;
- a Expected deceleration with normal functioning of the drive brakes in m/s^2;
- g Gravity;
- β Reduced longitudinal sway.

The longitudinal sway of the carriers of reversible aerial ropeways in the stations shall be established by monitoring the speed; a minimum value of 0,15 rad shall not be exceeded.

In the case of faults with aerial ropeways, for example malfunction of drive brakes, hold-up of the carriers when leaving the stations, blockage at entry to or exit from stations or on the line, or in the case of faults on reversible aerial ropeways, like for example, unforeseeable function of the drive brakes, carrier truck brakes, with:

— open, occupied carriers, impacts against the ropes or fixed components shall be avoided;

— closed carriers, in the event of impacts against the ropes or fixed structures, the permissible impact speed shall not be exceeded.

The permissible impact speed at the height of the centre of gravity of the cabin, is as follows:

a) uni-directional aerial ropeways:

   1) impact against a stationary object when passengers are transported standing: 1,5 m/s;

   2) impact against a stationary object when passengers are transported sitting: 2,5 m/s;

b) reversible aerial ropeways:

   1) impact against line structures (e.g. rope shoes): 3,5 m/s;

   2) impact against ropes: 5,0 m/s;

   These requirements shall be demonstrated by calculation or testing.

   Deviating regulations in accordance with EN 13796-1 may be applied for maintenance carriers.

6.3.6 Hand, foot and ski area

In the case of closed carriers, the hand area

— of window openings that can be reached into is 1,00 m.

— of hopper windows where the lower edge of the open window is at least 1,80 m above the floor of the carrier: 0,20 m;

— of hopper windows where the lower edge of the open window is 1,50 m to 1,80 m above the floor of the carrier: 0,50 m.

In the case of open carriers (particularly in chairlifts), the hand and foot areas of each seat are defined in the form of a four-sided pyramid, the base of which is formed by the surface of the seat (per person) and the height of which is 1 m. The hand and foot area is 0,5 m in all directions from the surface of this pyramid.

In the case of bucket lifts, the hand area is 1 m in all directions from all sides of the bucket.

The ski area is located in a plane 0,5 m below the seat surface and parallel with it. The length of the ski area extends 1 m in front and behind in the direction of travel, measured from the vertical plane passing through the front edge of the seat. The lateral edges of the ski area are located in the vertical planes of the lateral edge of the seat.

6.3.7 Guides

Guides used to restrict the transverse sway of carriers of aerial ropeways can be attached under the following conditions:

a) The safe support of the ropes shall not be compromised by the presence of guides; the longitudinal sway of the carriers shall also be taken into consideration.

b) Guides on line structures of a cableway installation with closed carriers shall be located approximately at the height of the centre of gravity of the carriers. Higher guides may be located on the line support structures of bi-cable uni-directional aerial ropeways (suspension guides).

c) Guides shall be attached outside of the hand area.

d) Guides in stations shall be configured so as to prevent a cabin

   1) from overriding in the case of transverse sway of 0,34 rad;

   2) in the case of longitudinal sway in accordance with 6.3.5;

   3) in the case of simultaneous transverse sway of 0,25 rad and longitudinal sway of 0,15 rad;

   whereby the transverse sway to be taken into consideration can be restricted by physical means (e.g. design of the suspension for aerial ropeways with double track ropes) to below the specified values.

e) Guides in the stations shall be designed so as to prevent the hooking together of chairs with a transverse sway of 0,50 rad;

f) Guides on line support structures and rubbing strips on cabins shall be arranged so as they are not overridden with

   1) the cabins with a transverse sway of 0,34 rad; as well as

   2) in the case of simultaneous longitudinal sway of 0,34 rad and a transverse sway of 0,20 rad;

   whereby the transverse sway to be taken into consideration can be restricted by physical means (e.g. design of the suspension for aerial ropeways with double track ropes) to below the specified values.

6.4 Limit profile of ski-tows

6.4.1 General

The following shall be taken into account for the limit profile of ski-tows:

— the transverse sway of the tow-hangers (6.4.3);

— the longitudinal sway of the tow-hangers (6.4.4);

— rotation of platters, T-bars or rods over the towing rope of the ski-tow (6.4.5).

The combination of transverse and longitudinal sway may be ignored.

6.4.2 Width of the tow-track

The width of the tow-track shall be at least:

a) with tow-hangers for 2 persons: 2,5 m;

b) with tow-hangers for 1 person: 2,0 m.

This minimum width shall be increased by 0,50 m on bridges and in cuttings.

6.4.3 Transverse sway of the tow-hanger

If there are no guides, a transverse sway of the retracted tow-hangers of at least 0,25 rad in relation to the fixed installation parts of the installation (for example station equipment, line support structures, roller batteries, maintenance platforms, ladders, rope catchers) shall be considered as well as between the tow-hangers themselves.

This value does not apply to grips in relation to the flanges of rollers for towing ropes.

Lower values are permissible in stations and at deflection line support structures, as well as in the case of ski-tows equipped with rods, if guides are installed.

6.4.4 Longitudinal sway of the tow-hanger

The longitudinal sway of springboxes shall be restricted in order to prevent springboxes from touching fixed parts of the installation or the rope.

6.4.5 Rotation of platters, T-bars or rods

A rotation of a non-extended tow-hanger above the towing rope shall be taken into account with regard to equipment that does not belong to the cableway on the rope that is occupied with passengers and in the area of the return pulley. In the case of springboxes, additional space of 2 m shall be taken into consideration.

6.4.6 Freedom of sway

In the case of springbox tow-hangers, the freedom of sway of retracted platters or T-bars shall be limited in relation to the springbox.

6.5 Limit profile of the signal, restraint and marker ropes

The following shall be taken into account for the limit profile:

— the lateral deviations of the ropes in accordance with 6.3.2;

— the vertical deviations of the ropes as a result of the effects of increasing ice load according to EN 12930.

A simultaneous action of wind and ice shall be taken into consideration when out of operation, and, provided the ice cannot be removed, also when in operation.

The lateral deflections of parallel ropes (and also when parallel to other cableway ropes) shall be examined in the same way as the determination of the cableway gauge in accordance with 7.4.

6.6 Limit profile of ropes of evacuation railways

The limit profile within which the ropes on evacuation railways can lie shall be examined both for the load case “evacuation rope in operation” and the load case “evacuation rope out of operation”.

The following shall be taken into account for the limit profile:

— the lateral deviations of the ropes in accordance with 6.3.2;

— the vertical deviations of the ropes as a result of the effects of increasing ice load according to EN 12930.

A simultaneous action of wind and ice shall be taken into consideration for the load case “evacuation rope out of operation” and, if the ice cannot be removed, also for the load case “evacuation rope in operation”.

The lateral deflections of parallel ropes (and also when parallel to other cableway ropes) shall be examined in the same way as the determination of the cableway gauge in accordance with 7.4.

The limit profile of evacuation ropes shall not affect the limit profile of the cableway installation. For the limit profile of ropes of a cableway installation in the case “out of operation”, the provisions of 7.1.5 apply.

7 Clearance profile, safety distances, track gauge

7.1 General

7.1.1 The clearance profile of a cableway installation is made up of the limit profile as per Clause 6 and the required safety distances.

7.1.2 The free spaces required for passageways for passengers and for work and traffic areas for operating personnel shall be planned in accordance with 11.

7.1.3 The clearance profile of a cableway installation shall not penetrate the limit profile of another cableway installation or the clearance profile of a passageway.

The limit profile of a cableway installation shall not penetrate the clearance profile of an electricity line.

Hazard zones which are given for other installations or equipment as well as, if required, safety distances, shall be taken into consideration.

7.1.4 When establishing the clearance profile of electricity lines, the protective distances from an electro-technical perspective shall also be observed. For cableways which approach, cross or run parallel with electrical cables, the applicable national regulations shall be observed.

7.1.5 When out of operation, the limit profiles may overlap ropes of a cableway installation on which there are no carriers.

7.2 Safety distances for funicular railways

7.2.1 A minimum safety distance of at least 0,1 m shall be provided between the limit profiles of carriers of a funicular railway as well as between the limit profile of a carrier above and to the side of any fixed structure or

civil engineering. With the exception of parts of the installation which shall be arranged more closely for functional reasons (for example, track, platform and proximity switch equipment).

7.2.2 Passageways for operating personnel along the line shall be located outside of the limit profile according to 6.2, whereby the hand area does not have to be taken into consideration. The passageways shall be at least 0,6 m wide and have a minimum clear height of 2,0 m. They are also intended for the evacuation of passengers; the provisions of 13.3 and of EN 1909 apply.

7.2.3 In specific cases (for example in tunnels and on bridges), passageways for servicing work when the installation is not in operation shall be provided on either side of the limit profile; the minimum width on one side may be reduced to 0,3 m.

7.3 Safety distances for aerial ropeways

No safety distances are required for structural items of rope supports or for parts of installations which shall be arranged more closely for functional reasons (e.g. servicing platforms, safety devices). Otherwise, the following safety distances shall be observed:

a) for ground, for civil engineering works – whilst taking into consideration any snow covering – as well as for fixed structures: at least 1,5 m;

b) for areas which are accessible to persons who are not part of the personnel - whilst taking into consideration any snow covering; at least 2,5 m;

c) for trees:

   1) in operation: at least 1,5 m;

   2) out of operation: no safety distance required;

d) for ski runs which are driven by piste grooming machines – whilst taking into consideration any snow covering: at least 4,0 m;

e) for ground that is driven by agricultural commercial vehicles: at least 4,0 m;

f) for clearance profiles of passageways (e.g. roads, car parks): at least 1,0 m;

g) for limit profiles of cableway installations: at least 1,5 m;

h) for fixed components of cableway stations in areas without carrier guides laterally towards the outside of the line – except for cases in accordance with i) 3: at least 0,5 m;

i) for fixed components in chairlift stations at the height of the seat of the freely suspended empty carrier:

   1) laterally to the line axis in areas without guides which restrict the transverse sway of the carriers: at least 0,8 m;

   2) laterally to the line axis in areas with guides which restrict the transverse sway of the carriers: at least 0,6 m;

   3) laterally towards the outside of the line: at least 1,0 m.

   All previously mentioned safety distances can be reduced by 0,5 m in the vertical direction in the case of a complete pressure loss of the hydraulic system of the tensioning device if this cannot be structurally prevented.

In addition, the work areas prescribed in Clause 11 shall be observed.

The provisions of a) and b) do not apply to the areas within stations.

If the requirements b), d) and e) are not met, the attainment of the limit profile of the cableway installation shall be prevented whereby protective structures (for example, railings, fencing) shall be provided at a lateral distance of at least 1,5 m from the limit profile.

For chairlifts, on each rope intended for the transport of skiers, these safety distances shall be increased vertically by 0,50 m.

7.4 Track gauge for aerial ropeways

For the justification by calculation of the choice of an adequate track gauge, the limit profile in accordance with 6.3 shall be taken into account, permitting transverse sway of occupied or unoccupied carriers of 0,20 rad towards each other and taking into account the hand, foot and ski areas if necessary. With regard to the ropes and carriers, no lateral deviation due to wind shall be assumed on one side of the track; on the other side of the track, a lateral movement due to wind shall be assumed in accordance with 6.3.2 for the “in operation” case. Greater values for the dynamic pressure shall be used if required by special local circumstances.

In the case of reversible aerial ropeways and pulsed movement aerial ropeways, the dynamic pressure that impacts on the carriers shall not be reduced.

In the case of bi-cable aerial ropeways, the track gauge shall be tested whilst taking into consideration the lateral deflection of the haul rope on the opposite line.

7.5 Clearance profile and safety distances for ski-tows

7.5.1 Line support structures and other stationary objects shall be at least the following distances from the centre of the tow-track, up to a height of 2,0 m above the surface of the snow:

a) for ski-tows with tow-hangers for 2 persons: at least 1,50 m;

b) for ski-tows with tow-hangers for 1 person: at least 1,25 m.

The centre of the tow-track is located in the vertical plane of the non-deflected towing rope.

7.5.2 If the terrain presents particular hazards to any user who may fall and slide down, suitable measures shall be taken; for example: protective padding, catch nets and catch trenches meet this requirement.

7.5.3 When a ski run runs immediately alongside the tow-track, the tow-track shall be marked.

7.5.4 The distance between the centre of the high-level tow-tracks shall be at least 3,5 m.

The distance between the centre of the tow-track of a low-level ski-tow and the centre of another tow-track shall be at least 15,0 m, provided no obstacle prevents travel from one tow-track to the other.

The centre of the tow-track is located in the vertical plane of the non-deflected towing rope.

7.5.5 Crossing points with ski runs at the same level shall be avoided whenever possible and are completely forbidden within 15,0 m of loading and unloading areas in the catchment area of the tow-hangers and on low-level ski-tows.

If such crossing points are installed, the safety of the users of the ski-tow and skiers on the ski run is to be ensured by appropriate means, for example, signs and guiding devices.

NOTE Guiding devices can ensure that the piste users can only enter the crossing area at an appropriate speed.

7.5.6 If a tow-track passes over a bridge, the latter shall be equipped with solid railings to a height not less than 1,0 m above the snow surface on the bridge.

8 Maximum permissible height above ground

8.1 General

8.1.1 The maximum permissible height above ground for the rope on which the passenger is travelling shall always be chosen taking into account the possibility of evacuation.

With regard to evacuation, Clause 13 and EN 1909 are applicable.

8.1.2 The maximum height above ground of aerial ropeways shall be calculated for the most unfavourable load case with the aerial ropeway at rest with nominal tensioning force. The transverse slopes of the ground shall be taken into account.

8.2 Aerial ropeways with closed carriers

8.2.1 The rope profile shall be designed with a maximum height above ground not greater than 60 m.

8.2.2 In the event of an evacuation the height above ground may in individual segments exceed 60 m if no more than five carriers can be simultaneously within this segment on either side of the cableway.

8.2.3 For sections of aerial ropeways where provision is made for evacuation along the rope, there is no restriction on the height above ground.

8.3 Aerial ropeways with open carriers

8.3.1 The rope profile shall be designed with a maximum height above ground not greater than 15 m.

8.3.2 The height above ground of 15 m may exceed 10 m at the most over a slope length of not more than

— 200 m, if the track length is not greater than 1 000 m;

— 20 % of the track length, if this is greater than 1 000 m.

Each stretch of line with a height above ground of more than 15 m may be not more than 100 m long and each stretch of line with a height above ground of more than 20 m may not be more than 50 m long.

9 Operating speed and interval

9.1 Operating speed of funicular railways and aerial ropeways, general

9.1.1 The maximum permissible operating speed of funicular railways and aerial ropeways shall be chosen with reference to the cableway system and its intended conditions of use. All aspects of the system shall be taken into consideration, particularly the following:

— the guidance of the moving ropes on their supports and the effectiveness of the rope catchers in the case of a derailment;

— the dynamic behaviour of the ropes, the rotating elements (e.g. sheaves, rollers) and the carriers;

— the attaching and detaching of the grips;

— the effects of deceleration during expected and unplanned activation of the drive brakes or other braking procedures (e.g. operation of an on-board brake, jamming of a carrier in the coupling area);

— the effects of swaying of carriers (e.g. impact against lateral guides when entering a station);

— the intended organization of passenger loading and unloading;

— the derailment and/or jamming of a carrier truck at a line support structure;

— the comfort of the passengers, taking into account passage past line support structures, the type of carrier, etc.

9.1.2 Calculations and/or precommissioning inspection results shall be presented to demonstrate that safety is ensured with regard to rope guidance and efficacy of the rope catchers, with the carriers on the line and in the stations and during their entry into the stations, taking into account:

— the actual decelerations and accelerations;

— the interval;

— the longitudinal sway of the carriers.

9.1.3 For funicular railways, account shall also be taken of Clause 5.

9.1.4 For aerial ropeways, the operating speed shall be chosen such that the centripetal acceleration does not exceed 2,5 m/s^2 when passing line support structures.

9.2 Maximum operating speeds of funicular railways and aerial ropeways

9.2.1 For funicular railways: 14,0 m/s.

In the vicinity of stations, the provisions of 11.1.7 shall also be complied with.

9.2.2 For reversible bi-cable aerial ropeways

a) away from rope spans: 12,0 m/s;

b) above line support structures:

1) accompanied:

i. with one track rope: 10,0 m/s;

ii. with two track ropes: 12,0 m/s;

2) unaccompanied:

i. with one track rope: 7,0 m/s;

ii. with two track ropes: 8,0 m/s.

9.2.3 For bi-cable uni-directional aerial ropeways

a) on the line:

1) with one track rope: 7,0 m/s;

2) with two track ropes: 8,0 m/s;

b) in stations, the values of 9.2.5 b). apply.

9.2.4 For mono-cable aerial ropeways and double mono-cable aerial ropeways with fixed, closed grips:

a) on the line:

1) with one towing rope: 6,0 m/s;

2) with two towing ropes: 7,0 m/s;

b) in stations, the values of 9.2.5 b). apply.

9.2.5 For mono-cable aerial ropeways and double mono-cable aerial ropeways with detachable carriers:

a) on the line:

1) for closed carriers with one towing rope: 6,0 m/s;

2) for closed carriers with two towing ropes: 7,0 m/s;

3) for open carriers: 5,0 m/s;

b) in the stations in the loading and unloading areas:

1) closed carriers and buckets: 0,5 m/s, whereby in bends an increase in the operating speed of the carrier's outside edge due to the cornering shall be taken into account;

2) chairs:

i. of skiers: 1,3 m/s;

ii. of passengers who are sitting in the direction of travel: 1,0 m/s;

iii. of passengers who are sitting perpendicular to the direction of travel: 0,5 m/s.

9.2.6 Aerial ropeways with open carriers and fixed grips:

a) on the line: 5 m/s;

b) in stations:

1) for transportation of skiers on:

i. up to two-seater carriers: 2,5 m/s;

ii. three- or four-seater carriers: 2,3 m/s;

iii. carriers with more than four seats: 2,0 m/s;

2) when transporting pedestrians: 1,5 m/s.

i) up to two-seater carriers: 1,5 m/s;

ii) carriers with more than two seats: 1,0 m/s.

If, in the case of multiple-seat carriers, a limit of two persons is set, the speed can be increased to 1,5 m/s

Greater operating speeds are permissible for transporting skiers, but necessitate the use of devices that make it possible to reduce the speed difference between the passenger and the seat while loading to the values shown (see 11.2.9). Unloading safety shall be ensured so that the operating speed shall not exceed 2,8 m/s for carriers with one or two seats, 2,6 m/s for carriers with three or four seats and 2,2 m/s for carriers with up to six seats.

9.2.7 The deactivation of one or more safety devices during a recovery operation shall automatically limit the operating speed to 1,5 m/s.

9.3 Minimum interval and carrier pitch for uni-directional aerial ropeways

9.3.1 In the selection of the smallest interval and pitch between carriers on uni-directional aerial ropeways, account shall be taken of the load on the line and of the organisation of loading and unloading in the stations In the case of uni-directional aerial ropeways with detachable carriers, account shall also be taken of the method for decelerating and accelerating the carriers in the stations and of the passage of the carriers through the stations.

9.3.2 In the case of uni-directional aerial ropeways with detachable carriers, the movement of the detached carriers in the stations shall be monitored automatically.

Automatic monitoring is not required in station areas outside the deceleration and acceleration areas where:

— during normal operation, the carriers always remain unoccupied, or;

— where the occupied carriers travel at a constant speed not greater than 0,5 m/s.

In the case of incorrect movement of one of the detached carriers, the automatic monitoring device shall ensure that:

a) normally occupied open carriers do not approach closer than 0,5 m to the preceding carriers (safety distance);

b) the impact speed of a closed carrier against the preceding carrier does not exceed 1,0 m/s.

In the station areas where the movement of the occupied carriers is not monitored automatically, the carriers shall be monitored by the operating personnel.

When planning and executing the automatic monitoring, account shall be taken of:

— the permissible variation in the distance between two carriers;

— jamming of the preceding carrier;

— the reaction time between triggering by the monitoring device and application of the brakes;

— the lowest deceleration of the cableway produced by the braking system after triggering by the monitoring device;

— the longitudinal sway of the following carrier.

9.3.3 For chairlifts with fixed grips the interval shall be at least (4 + n/2) s if passenger access to the carriers is from the front and if only skiers are transported, n being the number of seats per chair and being less than or equal to 6.

If passengers load from the front of the carriers with a significant change of direction, i.e. an angle of 30° or more for skiers and an angle of up to 90° in relation to the loading direction for foot passengers, the interval shall be increased to at least 1,5 $\times$ (4 + n/2) s.

In all cases, if an interval of less than 1,5 $\times$ (4 + n/2) s is chosen, a device controlled by the carriers (for example, an automatic barrier) shall be installed at the entry to regulate access by skiers.

With regard to the design of the loading and unloading areas, Clause 11 applies.

9.3.4 The nominal interval between chairs with detachable carriers shall be at least 5,0 s.

9.4 Operating speed and interval for ski-tows

9.4.1 The maximum permissible operating speed shall be:

a) 2,0 m/s for low-level ski-tows;

b) 3,5 m/s for high-level ski-tows, with the proviso that starter damping is provided for operating speeds in excess of 2,0 m/s.

Some sports equipment which persons are carrying may require the reduction of these operating speeds.

9.4.2 The interval between two consecutive tow-hangers shall not be less than the following values, provided the track characteristics and arrangement of the loading and unloading areas permit:

a) for ski-tows with tow-hangers for 2 persons: 6,0 s;

b) for ski-tows with tow-hangers for 1 person: 4,0 s;

c) in the case of low-level ski-tows: 5,0 s.

The corresponding distance between two consecutive tow-hangers shall in all cases be at least 10 % longer than the total length of a fully extended tow-hanger or 30 % longer than the length of a fully extended rod.

In self-service installations, the interval may be reduced to 3,4 s for ski-tows with rods and to 5,0 s for ski-tows with springboxes and double bars, provided that:

— the access conditions are favourable and there are no major changes in direction for the access (access at an angle less than 30° in relation to the loading area), and;

— the loading area is free after approximately half of the interval, and;

— the unloading area slopes down and the conditions for departure after unloading are favourable.

10 Drive system (including brakes)

10.1 Drive systems for funicular railways and aerial ropeways

10.1.1 Funicular railways and aerial ropeways shall be equipped with a main drive system and a recovery drive system and, if the conditions for not requiring a recovery drive system are not fulfilled, also with a recovery drive system. The main drive system shall permit start-up under all operational loading conditions and shall permit movement in both directions. This also applies to the recovery drive system whenever this may be necessary for recovery.

In order to forego the installation of a recovery drive, the following conditions shall be fulfilled:

— the slope length of the installation shall not exceed 500 m;

— the number of carriers per rope shall not exceed 30;

— the installation can be recovered by means of gravity or the rescue of the passengers using appropriate additional devices (e.g. in the case of funicular railways along the line in accordance with 13.2, lighting, rest zone).

The need for an auxiliary drive system depends on the traffic requirements which the cableway installation shall fulfil.

10.1.2 Safe function of the drive systems shall be ensured regardless of the weather conditions.

10.1.3 The drive systems shall be easily accessible for maintenance work.

10.1.4 The main drive operating speed shall be capable of continuous variation over the entire expected speed range, and of being maintained during continuous operation regardless of load.

10.1.5 The energy source for the recovery drive system shall be independent from that for the main drive system.

10.1.6 The recovery drive system shall be separate from the main drive system.

The drive sheave shall be capable of easy separation from the main drive system and attachment to the recovery drive system where one of the following conditions applies:

a) for uni-directional aerial ropeways

1) the installation is the only means of transport serving the area and the evacuation plan provides for bringing the passengers back to the station after evacuation, or;

2) more than 100 occupied carriers or more than 200 passengers may simultaneously be on the line;

3) the evacuation conditions are unfavourable (e.g. awkward terrain, application of elaborate measures or when evacuating).

b) for reversible aerial ropeways

1) the installation is the only means of transport serving the area and the evacuation plan provides for bringing the passengers back to the station after evacuation, or;

2) the vehicle has more than 40 persons,

3) the evacuation conditions are unfavourable (e.g. awkward terrain, application of elaborate measures or when evacuating)

c) for funicular railways

1) the installation is the only means of transport serving the area and the evacuation plan provides for bringing the passengers back to the station after evacuation.

2) the line has tunnel sections more than 250 m in length;

3) the evacuation conditions are unfavourable (e.g. awkward terrain, application of elaborate measures or when evacuating).

10.1.7 The recovery drive system shall be designed to enable a recovery operation to be completed within approximately one and a half hours.

10.1.8 In the case of uni-directional aerial ropeways with detachable carriers, the devices for moving the carriers in the stations shall be equipped so that they are also capable of operation with the recovery drive system and so that the carriers can be recovered without great difficulty if these devices fail.

10.1.9 At least one of the drive systems (main drive or recovery drive) shall permit operation of the installation for maintenance work.

10.2 Braking systems for funicular railways and aerial ropeways

10.2.1 It shall be possible to bring the carriers to rest at any time under the most unfavourable operational loading and adherence conditions. The stopping distance shall be as short as the safety of the installation requires. With the exception of installations in which the safe braking of the carriers is ensured independently

of the moving rope, there shall be at least two independent braking systems in the drive station. The last of these braking systems shall:

— automatically replace the other system if its efficacy becomes insufficient;

— act directly on the drive sheave.

10.2.2 Funicular railways and in general reversible bi-cable aerial ropeways shall be equipped with on-board brakes. Reference is made to EN 13796-1. Part 2 of this Standard includes additional minimum requirements for the omission of the on-board brakes for bi-cable reversible aerial ropeways.

10.2.3 If the cableway installation can be brought to a standstill by normal operation of the recovery drive system, a single brake acting on the drive sheave, on the ropes or on the carriers is sufficient for the recovery drive system.

10.2.4 All braking systems shall be capable of bringing the installation to rest and holding it stationary under the most unfavourable operational loading condition.

Decelerations which may present a hazard to persons or hinder the correct behaviour of the ropes, carriers or other parts of the installation shall be prevented by appropriate measures. For deceleration values, reference should be made to EN 13223.

When on-board brakes cause a standstill, greater delays may occur which can represent a residual risk.

10.2.5 Safe function of the braking system shall be ensured regardless of the weather conditions. The braking system shall be easily accessible for maintenance.

10.3 Drive system and braking systems for ski-tows

10.3.1 The drive system shall be capable of starting up the ski-tow under any operational loading condition.

10.3.2 Appropriately marked emergency stop buttons, accessible to all persons, shall be provided at all loading and unloading areas. In the case of loading and unloading areas which are not supervised by operating personnel, these shall be made accessible for these persons and marked appropriately.

10.3.3 The drive system shall be equipped so that a suitable operating speed can be driven for inspection purposes in accordance with EN 12927 (all parts).

10.3.4 The stopping distance may be a maximum of 5 m under the most unfavourable loading conditions:

— at speeds greater than 2,5 m/s: the distance travelled by the rope in 2,0 seconds at the greatest permissible operating speed.

— at speeds up to 2,5 m/s: 5,0 m.

10.3.5 After stopping, the drive sheave shall not run back.

10.3.6 Safe function of the drive system and braking system shall be ensured regardless of the weather conditions. These systems shall be easily accessible for maintenance purposes.

11 Passageways and work areas

11.1 General

11.1.1 Passageways and areas intended for passengers as well as passageways for operating personnel and technical areas shall be suitably arranged.

The operator's post (control room) and other areas in which the operating personnel are permanently or temporarily present for the operating or monitoring of the installation shall be located so as to allow the loading and unloading areas, the stabilisation, safety and approach areas of chairlifts, and also the access and departure areas for installations with detachable grips and finally, for all installations, all of the measurement and control devices specific to cableway systems, to be overseen, and so as to enable all activities required during operation to be carried out in an ergonomic way.

11.1.2 Direction indicators and notices shall be provided to direct the flow of passengers. Operationally important areas or points (e.g. loading points, unloading points, waiting areas, clearance profiles of arriving or departing carriers) shall be marked.

11.1.3 Passageways shall be arranged so that they can be used safely by passengers and operating personnel in all weather conditions; to achieve this, constructional and also operational measures shall be taken.

Steps shall be provided for passageways intended for the pedestrians and which have a slope in excess of 10 %.

11.1.4 Except at loading and unloading areas, passageways for passengers shall be located outside the clearance profiles of the carriers. For particular requirements for loading and unloading areas for chairlifts and ski-tows, see 11.2 to 11.8.

In work and traffic areas for operating personnel, a lateral safety distance of at least 0,5 m shall be provided beyond the limit profile of carriers in the stations, up to a height of 2 m above the surface on which the personnel stand.

11.1.5 The clear height above passageways for passengers and above work areas shall in general be at least 2,5 m (see EN 13107).

For work areas for maintenance underneath carriers and where structural items cross passageways for operating personnel, a minimum clear height of at least 2,0 m is sufficient. For the parts of carriers of funicular railways that are subjected to periodic inspections and maintenance work, the clear heights can be reduced to 1,70 m at points where maintenance work must be carried out on site. If the clear height of 2,5 m is undercut, these structural items shall be lit or clearly marked with coloured markers. Both swaying and loaded carriers shall be taken into consideration when dimensioning these heights.

11.1.6 The width of the passageways in stations for passengers shall correspond to the passenger-carrying capacity of the installation, with a minimum width of 1,25 m except at check points for tickets and access points to chairlifts and ski-tows.

Passageways for operating personnel shall be designed with a minimum width of 0,6 m.

When the cableway installation is used by persons in wheelchairs, the passageways shall have the following characteristics unless technical or operational considerations do not permit:

— the floor should be level, or have ramps with a slope of maximum 8 %, whereby ramps with a slope of more than 5 % shall be provided with 1,5 m-long intermediate landings every 10 m; intermediate landings shall be provided when the direction of the slope changes:

— non-slip floor surface;

— no steps and no threshold greater than 2 cm, or 4 cm if chamfered.

Access control points or the ways around them shall be at least 0,9 m in width.

Corresponding requirements shall be fulfilled for access ways to chairlifts and ski-tows for persons in wheelchairs or for disabled persons, and in particular a horizontal waiting area.

11.1.7 At all points where there is a danger of falling, the passageways and areas shall be equipped with rigid railings; see also EN 13107.

NOTE There is a danger of falling at any point situated more than 1 m above the adjacent surface or if the adjacent terrain slopes down more than 60 %.

In passenger areas, these railings and safety barriers (mobile railings) installed at the edges of platforms shall also prevent children from falling. In the absence of barriers (e.g. on funicular railway platforms), the edges shall be marked.

When carriers pass through or enter stations of a funicular railway – apart from automatic funicular railways where Clause 15 shall be observed – the speed shall be limited to a maximum of 1,0 m/s if:

— the carriers are unaccompanied and;

— no barriers are provided on the platforms and;

— passengers can access the platform.

In stations, the horizontal distance between the carrier entry / exit edges and the edge of a platform shall not be greater than 50 mm.

In stations where loading or unloading is carried out while the carrier is at a standstill, the horizontal distance between the carrier entry / exit edges and the edge of a platform shall not be greater than 75 mm.

When transporting persons in wheelchairs, the vertical distance between the carrier entry / exit edges and the edge of a platform shall not be greater than 50 mm.

11.1.8 At locations where it is not possible to install railings because of the clearance profile of the carriers (e.g. at the beginning or end of chairlift loading and unloading areas and at the station entries and exits in uni-directional aerial ropeways), a catching device in the form of a net (catch net) shall be installed no more than 1 m below the edge.

The catching device shall project at least 3,0 m horizontally and shall be arranged so that it is at least 0,5 m wider than the opening in the railing on both sides. In the case of chairlifts, account shall also be taken of the limit profile in accordance with 6.3 and of the requirements of 7.3.

In place of a catch net, a suitable arrangement of the terrain adjacent to the station shall also be shown.

11.1.9 Chairlift loading and unloading areas shall be arranged so that they meet the requirements of the mode of operation envisaged (transportation of foot passengers, skiers and disabled persons) The arrangement of waiting areas, access ways to the loading area as well as to the exits and reception areas beyond the unloading area shall be suitable for the passenger-carrying capacity of the installation and for the capacity of the individual carriers.

Passengers shall be protected from getting caught up in the station structures. Sidewalls shall have a smooth surface. Structures in the stations which could aggravate the consequences of a fall (e.g. foundation bolts) shall be provided with suitable covers.

In the case of adjacent cableway unloading areas that are used by skiers, suitable guards shall be used to ensure that skiers do not obstruct each other.

11.1.10 For chairlifts, the distance between the surface of the loading or unloading areas and the seat surface under static load shall be 40 cm to 55 cm in the loading area and 45 cm to 60 cm in the unloading area; the distance shall be measured at the middle of the front edge of the seat. The distance shall take into account any layer of snow required for operation. The station dimensions shall permit a chair with a closed foot rest to pass through.

In loading and unloading areas, the transverse slope of the seat surface under a static load on one side shall not exceed 10 %. If applicable, technical provisions shall be made in order to meet this requirement.

11.2 Chairlift loading areas

11.2.1 In addition to the requirements of 11.1, the following requirements shall also apply to chairlift loading areas. The sketch in Annex A is provided for clarification.

11.2.2 The loading areas of chairlifts shall be rectilinear.

The horizontal length of the loading area for the transportation of both foot passengers and skiers shall be between 2,5 m and 3,5 m. The loading point, which shall be marked, shall be located one-third of the way along.

In the case of chairlifts with fixed grips, the horizontal length of the loading area shall start after the passage of the chairs around the sheave. Beyond this horizontal length, a stabilisation area and a safety area prepared in conformity with 11.2.3 shall be provided.

Along the loading area, clearances shall be provided over a minimum height of 2 m on either side of the freely suspended carrier. These shall have the following widths across the carrier:

— laterally to the line axis for carrier operating speeds up to 1,3 m/s: at least 0,6 m:

— laterally to the line axis for carrier operating speeds in excess of 1,3 m/s: at least 0,8 m:

— laterally towards the outside of the line: at least 1,25 m.

11.2.3 The length of the stabilisation area shall correspond to

— a travel time of 3,5 s, measured from the loading point, and;

— the length of the stopping distance after an emergency stop which is triggered at the end of the loading area.

When establishing the length of the stopping distance, the emergency stop with the lowest deceleration should be taken into consideration so that competent employees are available to monitor the loading process.

The safety area adjacent to the stabilisation area ends after a travel time of at least 7,0 s, measured from the loading point.

The ramp after the loading area shall be designed with between 20 % and 40 % slope up to a height above ground of approx. 1,5 m. After the end of the ramp, the height about ground in the stabilisation area shall be approx. 1,5 m. The height above ground in the safety area may be increased to maximum 3 m.

11.2.4 If there is a sudden increase in the height above ground at the end of the stabilisation area (i.e. a gradient greater than 60 %), a catch net shall be provided in accordance with 11.1.8 if the height above ground is greater than 1 m.

11.2.5 When transporting skiers, the surface of the ground in the stabilisation area shall be arranged so as to allow their equipment to slide; it shall also be possible for operating personnel to provide assistance, and for the passengers to leave this area without difficulty.

The width of the stabilisation area shall meet the requirements of 11.2.2.

11.2.6 Separate access ways shall be provided for skiers and foot passengers. Foot passengers shall only use the skier access ways in exceptional cases (e.g. if the transportation of foot passengers is infrequent) and if the requirements of 11.1.3 are met.

11.2.7 The stationary components of devices for regulating access (e.g. barriers) required by 9.3.3 shall be located at least 0,6 m outside the limit profile of the carriers. A horizontal waiting area shall be provided in front of any such device and a slight downward slope towards the access to the loading point after it.

11.2.8 The position of the loading area of chairlifts with detachable grips shall be selected within the station so that the carriers advance at a constant speed at least up to the middle of the loading area in accordance with 9.2.5.

Direct access by the skiers to the loading area of such chairlifts without any major change in direction (see 9.3.3) shall be arranged and shall be controlled by an automatic regulation device.

11.2.9 For a chairlift with fixed grips whose loading area is equipped with a loading band, the following additional conditions shall be met:

a) the operating speed of the loading band shall vary with that of the towing rope and shall not exceed 1,0 m/s;

b) the speed of the carrier relative to the loading band shall not exceed the speed indicated in 9.2.6 b) 1);

c) the length of the passenger loading band, the position of the access regulation device and its control shall ensure that the earliest possible loading point for any chair is located after the chair has passed around the sheave and that there is at least 1 m between the latest possible loading point and the end of the band;

d) for the determination of the lengths of the stabilisation and safety areas in accordance with 11.2.3, a notional loading point shall be taken at the mid-point of the length of the loading band;

e) access for skiers shall be in the direction of the loading band and shall be regulated by an automatic device whose operation is controlled by the position of the carriers in accordance with 9.3.3;

f) the requirements of EN 13223 shall be observed.

In the event of failure of the automatic access-control device, operation using the loading band shall not be permitted.

11.2.10 With chairlifts where the loading area changes as a result of a position change of the sheave, it shall be possible to adjust the access, the loading area and the stabilisation and safety areas respective to the position of the sheave. If there is a loading aid in accordance with 11.2.9, devices shall be provided to enable a daily check of the actual position of the loading band in relation to the sheave to be carried out simply.

11.2.11 At least the following information shall be provided in the field of vision of the passengers:

— mount here;

— close the safety bar;

— do not swing the chair.

11.3 Chairlift unloading areas

11.3.1 In addition to the requirements of 11.1, the following requirements shall also apply to chairlift unloading areas; the sketch in Annex B is provided for clarification.

11.3.2 The unloading areas of chairlifts shall be rectilinear.

The horizontal length of a chairlift unloading area shall correspond to:

a) the distance travelled by a chair in 3,5 s in the case of transportation of foot passengers;

b) in the case of transportation of skiers:

1) for chairlifts with fixed grips where the distance travelled corresponds with at least 1.3 s, however amounts to at least 1,5 m;

2) for detachable chairlifts, at least 1,5 m.

In addition, refer to 11.3.5 and 11.3.6.

Along the length of the unloading area, clearances shall be provided on either side of the carriers as they hang vertically, over a minimum height of 2 m, having a width corresponding to the provisions of 7.3 towards the line axis and 1,25 m towards the outside of the line over the width of the carrier.

When transporting more than 2 pedestrians per chair, a level passable area shall connect the unloading area including the associated free spaces in the direction of unloading. This shall be at least the same width as the unloading area including the associated free spaces and extend at least 1,25 m above the limit profile.

The exit for foot passengers shall be separate from that for skiers.

11.3.3 Immediately preceding the unloading area, an approach area shall be provided from which the passenger shall be able to see the unloading conditions. This is possible if the apex of the pyramid assumed for determining the hand area in accordance with 6.3.6 and representing an arriving chair is at the same height as or above the surface of the unloading area.

The length of the approach area shall correspond to the distance travelled by a chair in 5 s.

11.3.4 Within the approach area, the height above ground however as of the station entrance shall not exceed 3,0 m and shall be reduced in the direction of travel to the value specified in 11.1.10 This distance may be achieved by an appropriate terrain layout and/or by guiding the towing rope and/or by the provision of a catch net. In the case of chairlifts with safety bars that cannot be opened on the line and the locking of which is automatically monitored at the exit of the loading station, compliance with the greatest permissible height above ground in the approach area shall only be required after unlocking.

At the beginning of the unloading area, skiers shall be prevented from getting their skis caught in the structure of the unloading platform by means of a ramp. If there is a sudden change in ground level (see 11.2.4) greater than 1,0 m at the beginning of this ramp or if the height above ground exceeds 3,0 m, a catch net shall be installed taking into account the limit profile of the carriers.

11.3.5 When transporting skiers, an exit ramp beyond the unloading area shall be arranged so that:

— the skiers can continue without any great change in direction;

— the ramp for chairlifts with detachable grips has a gradient between 10 % and 20 %;

— the ramp for chairlifts with fixed grips has a gradient between 15 % and 25 %;

— the sloping exit ramp continues until the skiers are no longer within the clearance profile of the carriers (limit profile + 0,5 m safety distance to the side and underneath);

— for chairlifts with fixed grips, the start of the exit ramp shall be located at a travel time of at least 1,5 s before the axis of the drive or return sheave.

11.3.6 After the unloading area of

— chairlifts with fixed grips; as well as

— chairlifts with detachable grips without a subsequent loading area in the same station which is continuously manned;

a device shall be provided which automatically brings the installation to a standstill if a passenger does not manage to leave the carrier. The device shall be installed as close as possible to the unloading area. Within each line which a carrier travels after this installation, the ground clearance shall be a maximum of 2,5 m.

NOTE This device should not replace the monitoring duties of the station personnel in this connection in accordance with EN 12397.

11.3.7 For persons who fail to dismount from the carrier in time, an emergency unloading area shall be provided in which the distance between the surface of the emergency unloading area and the seat shall be maximum 1,0 m. The height above ground up until the emergency unloading area shall be maximum 2,5 m. The emergency unloading area may be dispensed with if the height above ground is maximum 1,0 m within a section of line behind the carrier after the device has been triggered, as per 11.3.6.

11.3.8 At least the following information shall be provided:

— open safety bar;

— dismount here and leave the unloading area;

in addition when transporting skiers:

— raise ski tips and ski poles.

11.4 Loading and unloading areas at intermediate chairlift stations

The requirements of 11.2 and 11.3 apply as appropriate to the loading and unloading areas at intermediate chairlift stations.

An intermediate station which is only open to the public periodically shall be capable of being arranged so that it can be regarded as a line structure during the period it is out of operation or when it is not manned by the operating personnel.

11.5 Ski-tow loading and unloading areas

11.5.1 Around the stations, barriers shall be provided to prevent danger to persons from swinging or retracting tow-hangers, from movements of the counterweight or from other moving parts of the installation.

Stations shall be arranged so that the access, loading and unloading areas and the exit can be used safely, and sufficiently large queuing areas shall be provided.

11.5.2 Direction signs shall be provided to guide passengers to and from the loading and unloading areas.

11.6 Ski-tow loading areas

11.6.1 Accesses and loading areas shall be arranged so as to allow the planned passenger-capacity to be achieved and to ensure that the acceleration of the passengers is as even as possible.

The loading area shall be more or less horizontal and at least 4,0 m in length. The distances required in 7.5.1 may be reduced by 20 % in the loading area. The loading area shall be arranged so that it is easy to correct the height of the snow.

11.6.2 For low-level ski-tows, dangerous proximity to the sheave, including the area of the down-going towing rope, shall be prevented by suitable devices (e.g. by means of housing, fencing, covers combined with safety interlocks or a dividing wall when loading between the towing rope and return rope).

11.6.3 In the case of ski-tows with springboxes, where access to the departure point takes place beneath the towing rope, the T-bars or platters shall remain at least 2,0 m above the surface of the snow.

In the case of self-service ski-tows, this applies to the springboxes. The distance between the platters or T-bars of these installations and the surface of the snow in the loading area shall be 0,6 m to 0,8 m.

For self-service, the passengers shall have an adequate view of the approaching tow-hangers. Self-service shall be clearly marked, as far as possible with standardised symbols.

Deviations are permitted if access is from the side of the tow-hangers.

11.6.4 At least the following information shall be provided in the field of vision of the passengers:

— it is forbidden to leave the tow-track and to slalom;

— in the case of a fall, leave the tow-track immediately;

— it is forbidden to get on or off except at stations;

— hold ski poles in one hand.

11.7 Ski-tow unloading areas

11.7.1 Unloading areas shall be arranged so that these can be vacated quickly and permit trouble-free retraction and stabilisation of the tow-hangers.

11.7.2 In the case of high-level ski-tows with springboxes, the height of the towing cable above the unloading area shall be such that retracted platters or T-bars remain at least 2,3 m above the surface of the snow. This distance applies to the springbox if passengers cannot be endangered by the platters, for example at operating speeds not exceeding 2,0 m/s with light platters, and if the descending line cannot be crossed by passengers after they have dismounted.

For ski-tows with rods, the minimum vertical distance of the towing rope above the surface of the snow shall be not less than the length of a retracted tow-hanger. If passengers can cross the downhill line after dismounting, the rod shall remain at least 2,3 m above the surface of the snow at the crossing point.

11.7.3 The unloading area shall be arranged horizontally or with a slight slope in the direction of the exit:

— for ski-tows with springboxes, immediately after a line support structure;

— for ski-tows with telescopic rods, so that the passengers release their tow-hangers immediately after the grip passes the last line support structure.

For ski-tows with rods, the gradient of the towing rope at the start of the unloading area shall be less than 25 %.

11.7.4 For ski-tows equipped with springboxes, the distance between the start of the unloading area and the next rope guide shall not be less than the distance travelled by the towing rope in 16 s at the maximum operational speed. For springboxes less than 2,5 m long, this may be reduced to 11 s, and for rods, to 6 s.

11.7.5 A reduction in the distances specified in 11.7.4 may take place if secure passage of the tow-hangers around the sheave is ensured by suitable measures (e.g. guides controlling the bar or platter until it is completely retracted).

11.7.6 Safety devices shall be placed after the unloading area, which shall stop the ski-tow if

— a passenger fails to release their tow-hanger, or;

— the tow-hanger does not retract, resulting in a hazard.

After the unloading area, the terrain shall be free from all unnatural obstacles for the length of the stopping distance after triggering the safety device.

11.7.7 For ski-tows equipped with telescopic rods, dismounting beneath the sheave may take place if the design of the arrival station permits it.

The gradient of the tow-track downhill from the unloading area shall not be greater than 20 % for a minimum length of 8 m.

This gradient may be increased up to 40 % over a minimum length of 15 m where a tow-hanger uncoupling device is provided at the unloading area.

11.7.8 Unloading under the sheave shall be avoided in ski-tows with springboxes; in exceptional cases, it may be permissible if the operating speed, length of tow-hanger and height of the towing rope permit a hazard-free passage around the sheave and retraction.

11.7.9 In low-level ski-tows, in the absence of other construction-related measures, a monitoring device shall be installed after the unloading area in order to prevent dangerous proximity to station equipment. Passengers shall not lose contact with the ground in the area of the monitoring device or beyond it for the stopping distance after the device has been triggered.

In view of the particular danger of this situation, an independent duplicate monitoring device shall be provided. These monitoring devices shall not independently reset.

The following distances for the monitoring devices shall be observed:

— to the hazard zone: at least the stopping distance;

— to the surface of the snow: at least 30 cm;

— to the rope without t-bar: maximum 20 cm;

— to the rope with t-bar: maximum 60 cm.

11.7.10 At least the following information shall be provided in the field of vision of the passengers:

— warning of the approach to the unloading area;

— release the tow-hanger;

— leave the unloading area immediately.

11.8 Ski-tow intermediate stations

For loading and unloading areas at intermediate stations, the requirements of 11.5 to 11.7 shall be complied with as appropriate.

12 Rope tension and guides

12.1 Rope tension

Maintenance of the rope tension within the range of permitted values verified by calculation and, if necessary, on the basis of tests shall be ensured. The regulations in accordance with EN 1908 shall also be observed.

Safe operation of the tensioning device and the devices for monitoring rope tension shall be ensured during operation regardless of the weather conditions. The devices shall be easily accessible for carrying out inspections and maintenance work during operation.

12.2 Rope guidance and support - General

12.2.1 Support and guidance of ropes on the line and in the stations shall be ensured by means of rollers, sheaves or shoes suitable for the characteristics of the ropes.

12.2.2 The general design of the installation and, in particular, the design of the rope supports shall reduce the effects of corrosion and fatigue on the ropes and allow the ropes to be inspected over their whole length including their end attachments. Refer to EN 12927 (all parts).

12.2.3 Measures shall be taken to prevent derailment of the ropes (e.g. from sheaves and shoes) on the line and in the stations. If it is not possible to eliminate all risks of derailment, rope catchers shall be provided which do not compromise the safety of the installation, taking into account the measures adopted for ensuring stoppage of the installation after detecting a derailment.

12.2.4 The support of the rope on the line shall be designed with sufficient bearing forces loaded on the supports to ensure lateral guidance and to prevent unforeseen lifting of the rope. For the bearing forces required on supports, refer to EN 12930. For the design and construction of supports, EN 13223 applies.

12.2.5 Measures shall be taken to reduce the risk of the carrier rotating over and around the rope or of ropes crossing over one another as a result of a sudden change in hauling tension, particularly when passing over line support structures.

12.3 Guidance and support of the haul ropes for funicular railways

12.3.1 Under normal operating conditions (normal service, stopping; emergency stop with drive motor; emergency stop with service brake with normal functioning brakes) – except when the carriers are actually passing – lifting the haul rope from its rollers is not permitted.

The haul ropes of a funicular railway may lift from the rollers on the line if:

— the haul rope follows a straight line in plan in the section of the line concerned, and;

— the operating speed is not greater than 5,0 m/s and;

— the carriages are always accompanied by an attendant.

12.3.2 Safety devices shall be provided which automatically trigger the stoppage of the installation if the haul rope is in an incorrect position in relation to the line rollers.

12.4 Guidance and support for bi-cable aerial ropeways

12.4.1 Devices shall be provided which stop the installation automatically:

— if there is contact between the haul rope and the track rope;

— if the haul rope takes up an incorrect position on the line or in a station in such a way as to endanger safety.

Touching or the misalignment for a brief period of time (0,5 seconds) shall cause the system to come to a standstill.

12.4.2 In addition to the rope catchers in accordance with 12.2.3, rope re-engagement devices shall be provided. If re-engagement of the haul rope using the re-engagement device cannot be ensured, devices shall be provided to stop the installation within a suitable time to ensure that the safety of the installation is not compromised, taking into account the measures envisaged for stopping the installation after detecting the derailment of the rope.

12.4.3 Provision shall be made to prevent any possible crossing of the ropes over one another.

12.5 Guidance of carrying-hauling ropes in mono-cable aerial ropeways

12.5.1 Roller batteries shall be adjusted so that the carrying-hauling rope runs as nearly as possible in the middle of the groove when travelling both forward and in reverse.

12.5.2 The ends of the roller batteries shall be equipped with rope re-engagement devices on the side towards the axis of the line. The rope re-engagement devices shall be designed so that they do not damage the carrying-hauling rope as it runs against them and so that the grips cannot be caught on them.

12.5.3 Roller batteries shall be equipped with rope catchers which allow the passage of the grips. Movement of the roller battery shall not adversely affect the proper functioning of the rope catcher or the correct passage of the grips through it.

12.5.4 Roller batteries shall be equipped with safety devices at their leading ends, which shall trigger the automatic stoppage of the installation if the rope derails. Roller batteries with more than 4 rollers in each load direction shall additionally be equipped with these safety devices at their trailing ends.

These devices shall operate even if the rope derails outside the rope catcher.

12.5.5 The loss of a roller or the abnormal wear of the roller lining as a result of seizure of a roller shall not lead to a grip becoming jammed.

12.5.6 On compression line support structures, in addition to rope catchers in accordance with 12.5.3, provision shall be made for catcher arms having a wider lateral reach.

12.6 Guidance of haul ropes in ski-tows

12.6.1 In the case of ski-tows with springboxes, the haul rope shall be located at such a height that the retracted T-bars or platters travel at least 2,3 m above the surface of the snow. If local conditions or the system prevent compliance with this, the necessary protective measures for each individual case shall be taken.

The angle between the extended towing cord and the vertical shall not be less than 0,30 rad in the most unfavourable case, to prevent passengers from being lifted off the tow-track.

12.6.2 In the case of ski-tows with rods, the vertical distance of the haul rope to the tow-track shall at no point of the tow-track be greater than the length of a tow-hanger with its platter extended under a load of 200 N.

12.6.3 For low-level ski-tows:

a) the haul rope shall run at such a height that its distance above the tow-track is more or less constant and so that only reasonable lifting up or pushing down on the rope is necessary to suit passengers;

b) the ascending rope shall not run over line support structures;

c) the length shall not exceed 300 m;

d) measures shall be taken to minimise the twist. The haul rope shall not turn in the t-bars.

12.6.4 At points of horizontal deviation (curves), the guides for the haul rope shall be located in the plane formed by the rope at either end of the curve (the plane containing the resultant rope tension). Before and after each deviation, rollers or sheaves in a vertical plane shall be provided.

For small deviation angles and for self-adjusting sheaves or rollers, rollers before and after the deviation of the rope are not required.

Steps shall be taken to ensure that in the event of derailment at deflection devices the haul rope is caught, either by the deflection device itself or by suitable rope catchers. Refer to 12.2.3.

12.6.5 The guidance of the haul rope on the line support structures and in the stations shall comply with the provisions of 12.2.3, 12.2.4 and 12.5.1 to 12.5.4.

13 Recovery and evacuation

13.1 General

If an aerial ropeway or funicular railway is stopped for a prolonged period, it shall be possible to inform the passengers quickly and ensure their return to a safe place within a reasonable period of time. Passengers shall be evacuated only if the carriers cannot be recovered within an acceptable timescale.

In the case of ski-tows, passengers shall be able to leave the tow-track at any place on the track to reach safe ground (e.g. a ski run).

An evacuation plan shall be drawn up for an aerial ropeway or a funicular railway.

Refer to EN 1909.

13.2 Evacuation pathway for funicular railways

In the case of funicular railways, if passengers are evacuated by a pathway alongside the track, this pathway shall have a width of at least 0,6 m. If there is a risk of lateral fall, the following shall be installed:

— a handrail on the side opposite the axis of the track, if the fall height is over 0,5 m;

— a railing along the edge, installed in accordance with 11.1.7, if the fall height is over 1,0 m.

If there are steps, provision shall be made for a handrail and rest areas.

Measures shall be provided to ensure safe departure from the carriers, also in the area of passing loops and crossing points.

13.3 Evacuation by descending by rope

In the case of aerial ropeways lines, evacuation of passengers by descending a rope is permissible up to a maximum height above ground of 100 m.

For sections of aerial ropeways having a height above ground in excess of 100 m, provision shall be made for evacuation along the rope.

14 Miscellaneous

14.1 Fire protection and fire-fighting

Fire protection and fire-fighting measures shall be provided for in the design, construction and operation of all cableway installations, and local fire prevention regulations shall be taken into account.

Hazards due to fire events in the vicinity of the cableway installation shall be taken into consideration.

In particular, the planned measures should take into account the fact that ropes and their end fixings may be affected by the effects of heat.

NOTE Reference is made to the CEN/TR 14819 (all parts).

14.2 Protection against lightning

For the buildings, line structures and equipment of cableway installations, provision shall be made for protection against lightning and applicable local regulations shall be taken into account.

If lighting is established or in the case of poor weather conditions which could give rise to lighting, the appropriate inspections in accordance with EN 1709 and EN 12927 (all parts) shall be carried out. In doing so, the rope shall be examined for any damage in particular.

14.3 Marking of obstacles to aircraft

If devices for marking the cableway installation as an obstacle to aircraft are necessary, they shall be considered as components belonging to the installation and dimensioned accordingly. This involves aircraft warning cables and their anchorages in particular.

14.4 Wind measurement devices

In the case of aerial ropeways, a measuring device to measure the speed and direction of the wind shall be provided in the area of the line where the greatest crosswinds are to be expected. In the case of funicular railways, a measuring device to measure the speed and direction of the wind shall be provided where a restriction of the operation due to wind is expected.

Measured values shall be displayed at least in the drive station, whereby a visual indication as well as visual and acoustic warning signals shall be triggered when an adjustable warning value is reached.

14.5 Materials

14.5.1 The components of a cableway installation shall be made of materials which correspond to the function of the components and are suitable for the purpose, taking into account the modes of manufacture and use and in particular the loading on the component.

14.5.2 Materials shall preferably be used which conform to European Standards.

When selecting materials, particular account shall be taken of the following requirements:

— the atmospheric conditions, the conditions of use (e.g. temperature, corrosion) and the anticipated service life of the components;

— adequate impact resistance and ductility corresponding to the conditions of use and;

— any properties which are hazardous to health, flammability and combustion behaviour corresponding to the conditions of use.

14.5.3 The materials shall be specified in the documents to be presented.

14.6 Instructions for passengers

Instructions regarding the behaviour of passengers shall be posted in the stations and in closed carriers as well as in and on the track in the case of chairlifts and T-bars. Refer to 11.2.11, 11.3.8, 11.6.4 and 11.7.10 as well as EN 12397.

14.7 Assembly instructions

The manufacturer and/or supplier shall make available assembly instructions to ensure safe construction.

14.8 Operating and maintenance instructions

The manufacturer and/or supplier shall provide operating instructions covering safe operation and maintenance of the cableway, including all necessary data; reference is made to EN 1709 and EN 12397.

The data shall include in particular:

— technical characteristics;

— starting up the installation;

— stopping the installation;

— checking the safety devices;

— maintenance (servicing, inspection, repair);

— rectification of defects;

— bringing the recovery drive and, if applicable, the auxiliary drive into operation;

— actions of the operating personnel in the case of recovery and evacuation (see EN 1909 and EN 12397);

— transport of operating personnel in special carriers which are not intended for transporting the public (.g. maintenance carriers);

— erection and dismantling of movable installations.

14.9 Technical documents

Adequate technical documents setting out the general design of the cableway as well as the details of the line shall be drawn up. Annex C specifies the minimum scope of the technical documents.

14.10 Lighting installations

14.10.1 Adequate lighting shall be provided at least in those areas which are used for operation and maintenance as well as for handling passengers (entrances and exits, loading and unloading areas, waiting areas); sufficient lighting which is independent of the normal power source (emergency lighting) shall also be provided.

14.10.2 Spotlights which ensure sufficient illumination of the stretch of line immediately outside the station area shall be fitted at stations in funicular railways and reversible aerial ropeways.

14.11 Radios

The cableway installation shall have an adequate number of radios available for use in the event of breakdowns, evacuation or maintenance.

15 Funicular railways with automatic operation

15.1 General

The automatic operation of funicular railways without the immediate presence of personnel at the installation may take place subject to the following conditions.

15.2 Operation monitoring

It shall be possible to reach the installation within 30 min in the event of a fault in order to take the appropriate action.

Closed circuit TV monitoring of the platform areas shall be provided with a monitor at the monitoring position.

15.3 Fencing off the line

Those parts of the line of the funicular railway which are accessible by unauthorised persons shall be fenced off.

The fencing shall be at least 1,8 m high. In rural environments, this may be reduced to 1,2 m.

15.4 Access to the line

Any doors in the fencing required in accordance with 15.3 shall be fitted with safety devices. If the doors are opened, the installation shall automatically be brought to a stop and further operation shall not be possible. The further operation of the installation may be permitted only after the line has been inspected and authorisation has been given by the personnel.

The doors shall not open inwards in the direction of the track.

When a door is also specified for use for the evacuation of passengers, it shall be possible to open it from the inside without a key, even if it is locked.

15.5 Evacuation

In the event of a stoppage, it shall be possible for passengers to evacuate from the carriers without danger by complying with instructions displayed in the carrier or communicated by the monitoring station. An evacuation pathway conforming to 13.2 shall be provided. It shall be possible to open the doors and emergency exits from the inside.

The passengers shall have at their disposal in the carrier an alarm button allowing them to notify the monitoring station.

If it is possible for operating personnel to reach the carriers within a short time after a stoppage, other evacuation methods may also be used.

15.6 Access to carriers

The station platforms shall be equipped with solid-walled sliding doors conforming to the specifications for carrier doors in accordance with EN 13796-1.

During operation, it shall not be possible (except for maintenance work) to open a sliding door (or any of its leaves) unless a carrier is at rest in the opening area of the sliding door.

If a sliding door (or one of its leaves) is open, it shall not be possible to start up the installation. If the installation is in motion and a sliding door (or one of its leaves) is opened, the installation shall be stopped automatically and an automatic restart shall not be possible. The further operation of the installation may be permitted only after the line has been inspected and authorisation has been given by the personnel.

In order to avoid the risk of trapping a passenger, the horizontal clearance between the carrier door and the closed sliding door on the platform shall not exceed 0,12 m up to a height of 1,8 m above the floor, unless additional monitoring of this area is provided.

As an exception to the requirement of 11.1.7, the horizontal clearance between the threshold of the carrier door and the threshold of the sliding door shall not exceed 35 mm.

15.7 Special safety devices on carriers

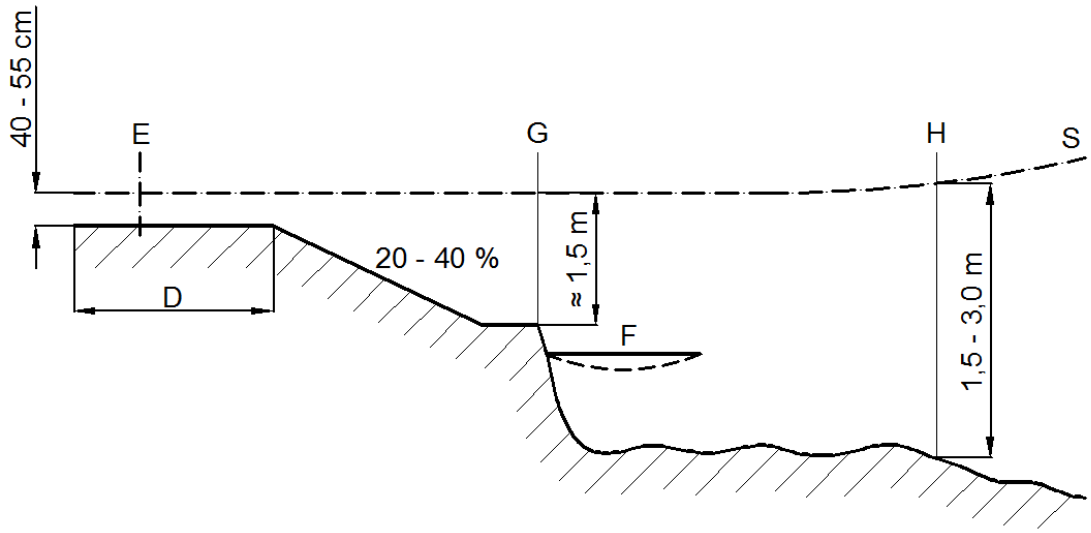
The requirements of EN 13796-1 shall be complied with.

15.8 Surveillance of the line

If there is a danger that trees may fall on the line, a safety device shall be provided which will detect such an event and automatically stop the installation.

Annex A
(normative)

Explanatory sketch for 11.2



Legend

D horizontal length of the loading area according to 11.2.2

E approach area according to 11.2.2

F catch net according to 11.2.4

G end of the stabilisation area according to 11.2.3

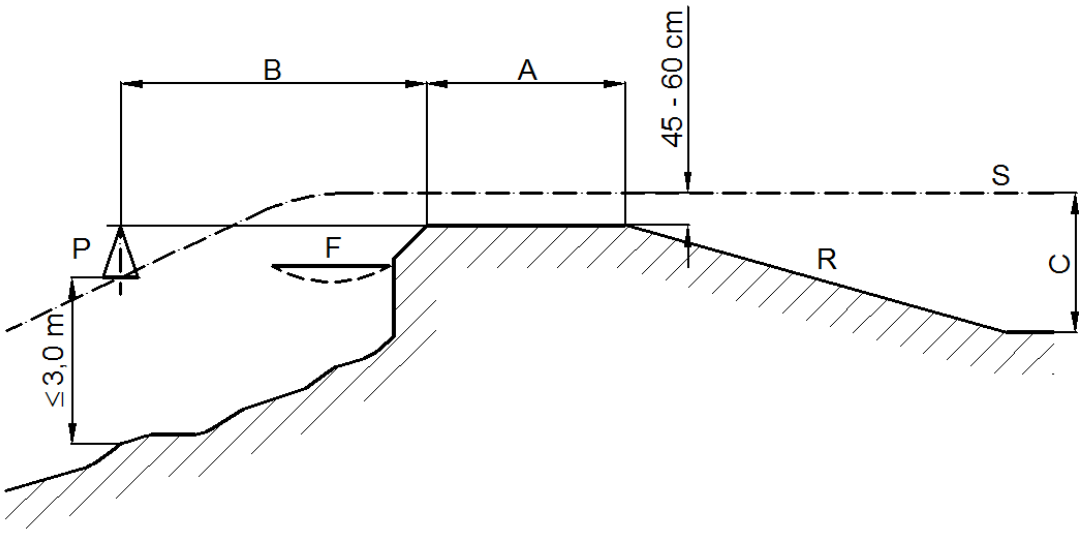
H end of the safety zone according to 11.2.3

S trajectory of the surface of the seats

Figure A.1 — Explanatory sketch for 11.2

Annex B
(normative)

Explanatory sketch for 11.3



Key

A horizontal length of the unloading area according to 11.3.2

B approach area according to 11.3.3

C ground clearance according to 11.3.7

F catch net according to 11.3.4

P pyramid according to 6.3.6

R unloading ramp according to 11.3.5

S trajectory of the surface of the seats

Figure B.1 — Explanatory sketch for 11.3

Annex C
(normative)

Technical documents

C.1 For all installations

A summary technical description of the installation including a site plan at an appropriate scale (e.g. 1:25 000). Safety report with a list of safety components. The summary description shall also consider the requirements of this document.

C.2 For funicular railways

C.2.1 A longitudinal profile (normally at a scale of 1:500 or 1:1 000) with an indication of the terrain, the position and altitude of the line structures, bridges, retaining walls and stopping points. The longitudinal profile shall also include – as simple lines with names – all crossing points with cableway installations, railway lines, roads, paths and other transport routes, watercourses, electricity lines and oil, gas and water pipelines.

C.2.2 Cross-sections, in particular for the zones where carriers meet and for the zones where clearances of the carriers are restricted laterally in the stations by buildings, rocks, etc. (for example at a scale of 1:50 or 1:100).

C.3 For aerial ropeways

C.3.1 A longitudinal profile (normally at a scale of 1:500 or 1:1 000) with an indication of the terrain, the position and altitude of the line structures, bridges, retaining walls and stopping points. The longitudinal profile shall also include – as simple lines with names – all crossing points with cableway installations, railway lines, roads, paths and other transport routes, watercourses, electricity lines and oil, gas and water pipelines, and also all the forested land and buildings over which the installation travels. In addition, it shall include:

— the catenaries of the unladen track ropes, haul ropes or towing ropes and the trajectories of the lower edges of the carriers at the maximum sags which may occur in each span;

— the decisive maximum heights above ground as well as the decisive minimum distances of the limit profile of the cableway installation from the ground;

— the minimum distance of the limit profile of the cableway installation from the above-mentioned installations, provided they protrude into the terrain;

— in the case of bi-cable aerial ropeways, also the lowest position of the haul rope in all spans.

C.3.2 Cross-sections, in particular for the zones where carriers meet and – for bi-cable installations – for the distance between the carrier and the haul rope and/or the counter rope belonging to the opposite line under the most unfavourable conditions, as well as cross-sections at points where clearances of the carriers or of the ropes are restricted laterally in the stations by line structures, buildings, rocks, etc. (normally at a scale of 1:50 or 1:100).

C.4 For ski-tows

C.4.1 Longitudinal profile (normally at a scale of 1:500) with an indication of the terrain as well as the position and altitude of the line structures and stopping points. The longitudinal profile shall also include - as simple lines with names - all crossing points with cableway installations, railway lines, roads, paths and other transport routes, watercourses, electricity lines and oil, gas and water pipelines.

C.4.2 Cross-sections in the stations, on the line, at the line structures, and if present, at transverse slopes, at embankments and earth banks, at bridges, at cuttings and at any locations where clearance is restricted laterally by buildings, rocks, etc. (normally at a scale of 1:50 or 1:100).

Annex D
(informative)

A–deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.

This document falls under Directive 2000/9/EC.

NOTE (from CEN/CENELEC Internal Regulations Part 2: 1994, 3.1.9): Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59, 9.3.1982) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted within the EU except under the safeguard procedure provided for in the relevant Directive.

Clause	Deviation
6.3.5	**Italy** The longitudinal sway for the carriers in uni-directional aerial ropeways is published by law: DPR 18/10/1957, n°1367, CFAT prot.n.3133(66)71.32 dated 05/08/1977, circolare D.G. n°77/90 D.C. V n°2/90 (art.11.8), circolare n°134/1987, DC V n°12/1987 (art.10.3) circolare D.G. n°127/1991, DC V n°7/91 (art.11.9)
8.3	**Italy** The maximum permissible height above ground for aerial ropeways with open carriers is published by law: D.P.R 18/10/1957, n°1367, D.M. 7/07/1960 n° 1235, D.M 16/06/1964 n°1541/0610, D.G. n°127/1991 V n°7/91

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of the EU Directive 2000/9/EC relating to cableway installations designed to carry persons

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to essential requirements of the New Approach Directive 2000/9/EC relative to cableway installations designed to carry persons.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national Standard in at least one Member State, compliance with the Clauses of this Standard given in Table ZA.1 confers, within the limits of the scope of this Standard, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Relationship between this European Standard and Directive 2000/9/EC relative to cableway installations designed to carry persons

Clause(s)/sub-clause(s) of this European Standard	Essential requirements of Directive 2000/9/EC	Qualifying remarks/Notes
4.3	2.1, 2.2, 2.9, 7.3.2	
4.4	2.1, 2.2, 2.6, 2.7.1	
4.5	2.1, 2.8, 3.1.1, 3.1.2, 7.3.1, 7.3.2	
Clause 5	2.3, 3.1.1, 3.1.2, 3.1.3, 5.6	
5.4	5	
Clause 6	3.1.1, 3.1.2, 3.1.3	
Clause 7	2.3, 3.1.1, 3.1.2, 3.1.3, 3.2.2	
Clause 8	3.1.1, 3.1.2, 3.1.3	
Clause 9	3.1.4	
Clause 10	3.1.4, 4.2, 5.7	
11.1	2.8, 3.2, 6, 7.3.1, 7.3.2	
11.2	3.2, 6	
11.3	3.2, 6	
11.4	3.2, 6	
11.5	3.2, 6	
11.6	3.2, 6	
11.7	3.2, 6	
11.8	3.2, 6	
Clause 12	3.2.1, 4.1	
13.1	3.1.1, 4.4, 7.2	
13.2	3.1.1, 7.2	
13.3	3.1.1, 7.2	

Table ZA.1 (*continued*)

Clause(s)/sub-clause(s) of this European Standard	Essential requirements of Directive 2000/9/EC	Qualifying remarks/Notes
14.1	2.6.5	
14.2	2.6.6	
14.3	2.3, 3.1.1	
14.4	2.3, 7.1	
14.5	2.4, 2.6.1	
14.6	7.1.1	
14.7	2.5	
14.8	2.8, 7.1.1	
14.9	2.8, 7.1.1	
14.10	7.1.2	
14.11	4.4, 7.1.2	
15.1	7.1.1	
15.2	3.3.2, 6, 7.1	
15.3	3.1.1, 7.2	
15.4	3.1.1, 7.2	
15.5	6	
15.6	6, 7.1	
15.7	3.1.1, 7.1	
15.8	3.1.1	
Annex A	3.2, 6	
Annex B	3.2, 6	
Annex C	2.8, 7.1	

WARNING Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

[2] CEN/TR 14819 (all parts), *Safety recommendations for cableway installations designed to carry persons — Prevention and fight against fire*

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